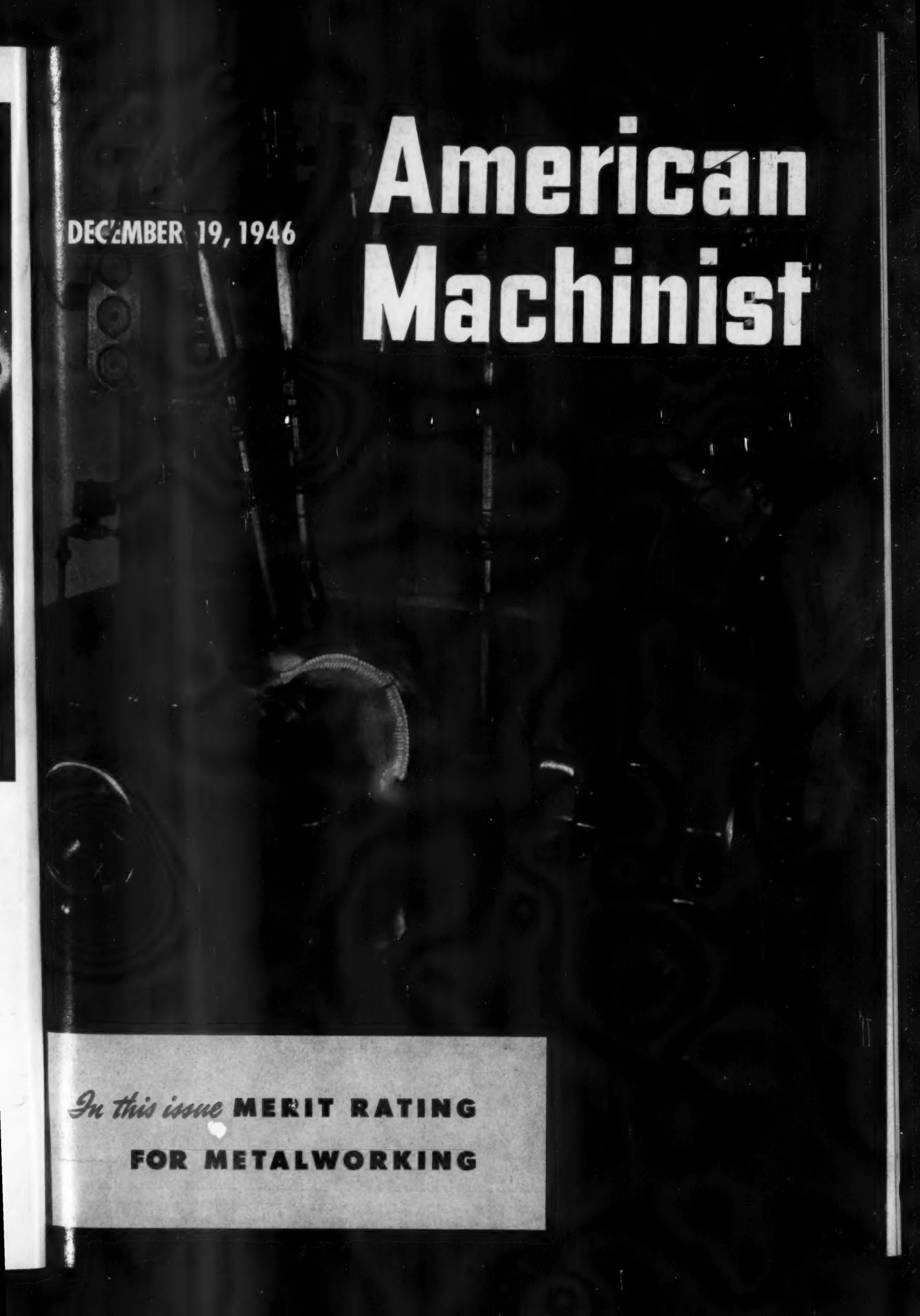
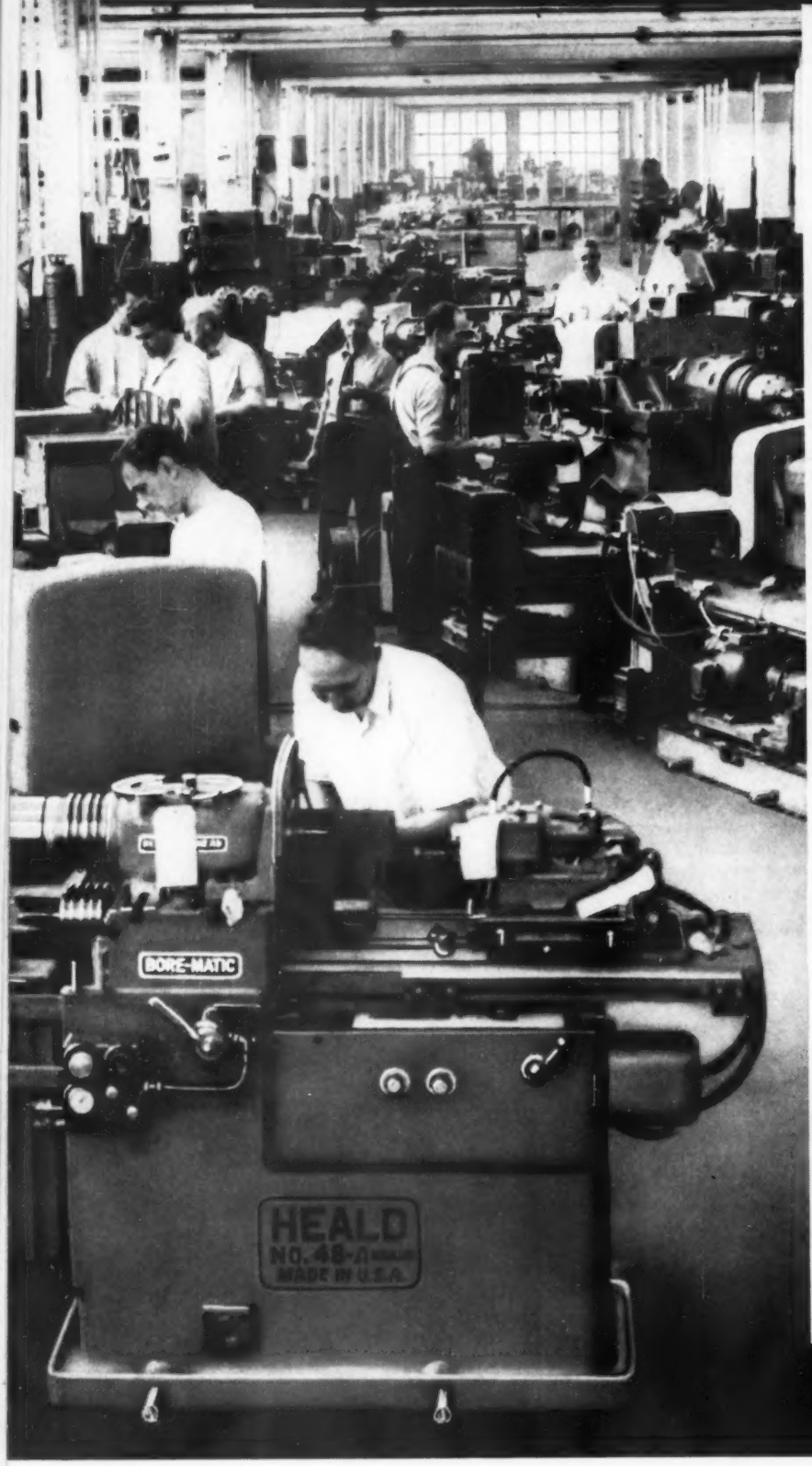


DECEMBER 19, 1946

American Machinist

In this issue **MERIT RATING FOR METALWORKING**

Your PRODUCTION LINE Starts Here



. . . on the Heald Run-Off Floor higher machining goals are met in less time, at less cost.

Before a Heald machine is ever delivered to the customer, it has already done the job it was ordered for—under actual shop conditions, here on the Run-Off Floor in the Heald Plant. This is the Heald testing ground, where new machines must prove that they're *better* machines, by doing the customer's job—whether it's grinding or borizing—with greater efficiency, greater economy, greater speed and greater precision.

For example, a method tested on the Run-Off Floor for grinding 200 bearing races an hour enabled another customer to turn out engine sleeves six times faster! Again, multiple Bore-Matic operations actually quadrupled the production rate on distributor cams. And when Heald engineers devised a way to finish automotive pump bodies three-at-a-time, with far greater accuracy, production jumped 127 per cent.

Results like these, proven on the Heald Run-Off Floor, can directly affect your machining operations—speeding output, eliminating rejects, saving man hours. If you have any precision finishing problems, Heald engineers will be glad to take them up with you. Chances are that your production line, too, will benefit from a tryout on the Run-Off Floor. Just call or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision

. . . less cost

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINE

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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CONTENTS for December 19, 1946.....VOL. 90, NO. 26

ADMINISTRATION

Editorial.....*Burnham Finney* 99
How to Apply Profit Sharing.....*Spencer A. Tucker* 108
Our Shop.....*O. Fluharty* 132
Who Pays for Breakage?.....*Round Table* 138
Industrial Machinery Exports Set a Record.....*John D. Wilson* 151
The Labor Crisis.....*James H. McGraw, Jr.* 164

SPECIAL REPORT

Merit Rating Strikes a Trial Balance.....*Harry S. Wharen* 117

ENGINEERING

Hobbed Gear Tooth Layout Simplified—3.....*Clyde A. Young* 133
Tapering for Surface Inspection.....*Lt. Col. W. J. Darmody* 134
How to Square Fractions.....*Carl P. Nachod* 143
How to Measure Radius of a Short Circular Arc....*J. Van Voast* 143
What's New in Auto Bodies.....*Chester Ricker* 149

MATERIALS

Abrasive Grains Produced Without Crushing.....*R. R. Ridgway* 110
How to Select and Treat Mold Steels.....*Ralph J. Hoensheid* 130

MATERIALS HANDLING

Fisher Body Aids Pressed-metal Handling.....*Rupert Le Grand* 112

MATERIAL CUTTING, FORMING

Diamonds Cut Plastics with Precision..... 101
Carbide Ball Burnishing for Bore-finishing.....*James Busch* 129
Shop Shots..... 136
Altered Tube Fittings Meet the Deadline.....*A. Kudola* 141
Lower Your Hacksaw Grip.....*Lawrence H. Seibert* 142
Old Rag Stops Chatter in Countersink Milling.....*L. H. Luke* 142

TOOLING

Fixtures Make Welders Flexible—1.....*Ed Reilly* 104
Floating Driver Speeds Mandrel-Mounted Work....*D. P. Ziemke* 139
Taper Pin Locks Boring Bars.....*L. W. & C. H. Spaulding* 139
Double-Eccentric Circular Cutters.....*J. Copeland & R. Holsing* 140
Mandrel Permits Quick Work Changes.....*Orville H. Gitter* 140
Different Drillheads Set Correct Tapers.....*Arthur F. Hird* 141
Drillrod Tool Cuts Ball Ends on Knobs.....*Francis B. Dial* 141
Layout Cube Combines Angle Plate, V-Blocks...*George Mattson* 142
Large Bushings Installed in Close Quarters.....*Herbert Weitz* 143

NEWS OF METALWORKING

Spot News..... 97
Gaging Business..... 154
Detroit Letter..... 157
Washington Bulletin..... 159
Labor..... 161
Names in the News..... 163

DEPARTMENTS

Talking Shop..... 116
Reference Book Sheets..... 145
Shop Equipment News.... 165
Parts and Materials..... 182
Seen & Heard..... 190
New Bulletin Insert..... 213

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Chips and QUIPS

Flame Hardening . . . Our cover Kodachrome pictures a universal flame-hardening machine working on one of the many cams for a LeBlond automatic crankshaft lathe. This machine also treats almost 400 other LeBlond parts, including the replaceable front and rear bedways now furnished on heavy-duty engine, toolroom and hollow-spindle lathes. This and similar methods and units have been designed by LeBlond metallurgical engineers, based on research during the past ten years.

This cam, an SAE 4140 steel casting, is accurately machined to contour, then the working surface is flame-hardened to 56-58 Rockwell C ⅛ in. deep with negligible distortion or change. Remaining surfaces are left soft for subsequent machining.

Supplement . . . Since our popular special report on "Job Evaluation" (Aug. 1 *A.M.*), readers have been applying pressure for a companion report on Merit Rating. This issue brings it—by the same author, Associate Editor Harry Wharen, who found his assigned eight pages insufficient, squeezed you 50% more space. . . . This seems to be frequent, for Dec. 19 also carries a 4-page bonus, required to bring you the auto-body meeting and machinery-export reports.

Watch Your Hat . . . Current hosts to Chief Editor Finney may notice his new Stetson and Alligator. His multi-windowed office is in a strategic—but sometimes windy—corner 29 floors above 42nd St. His *old* hat and coat were on a clothestree near an open window recently when the wind puffed. Hat and coat sailed majestically out of the window into the swirling masses of old Hell's Kitchen. No traces.

Tough Turning . . . Many of the newer materials are soft—but so abrasive they wear out tools. Plastics give plenty of trouble—so Boonton Molding now uses diamond tools. Associate Editor Flynn reports methods and results in our lead article (page 101)—developed as a result of reader requests for the data. . . . Also of interest to plastics fabricators—and die casters—is the article by Ralph Hoensheid of Commercial Steel Treat Corp., Detroit, on mold steels (p. 132).

Setups . . . Two articles answer calls for production tooling, one a sketch story by Ed. Reilly (page 104) on welding setups, the other by Associate Editor Le Grand (see biog.) on press setups at Fisher body (page 112).

Change . . . Paper now being a bit more plentiful, we gladden the hearts of many readers by increasing reference-book sheets 50% and printing them in two colors on heavier, longer-lived stock. A bonus of 33% in Practical Ideas every other issue will also warm your midden—we hope.

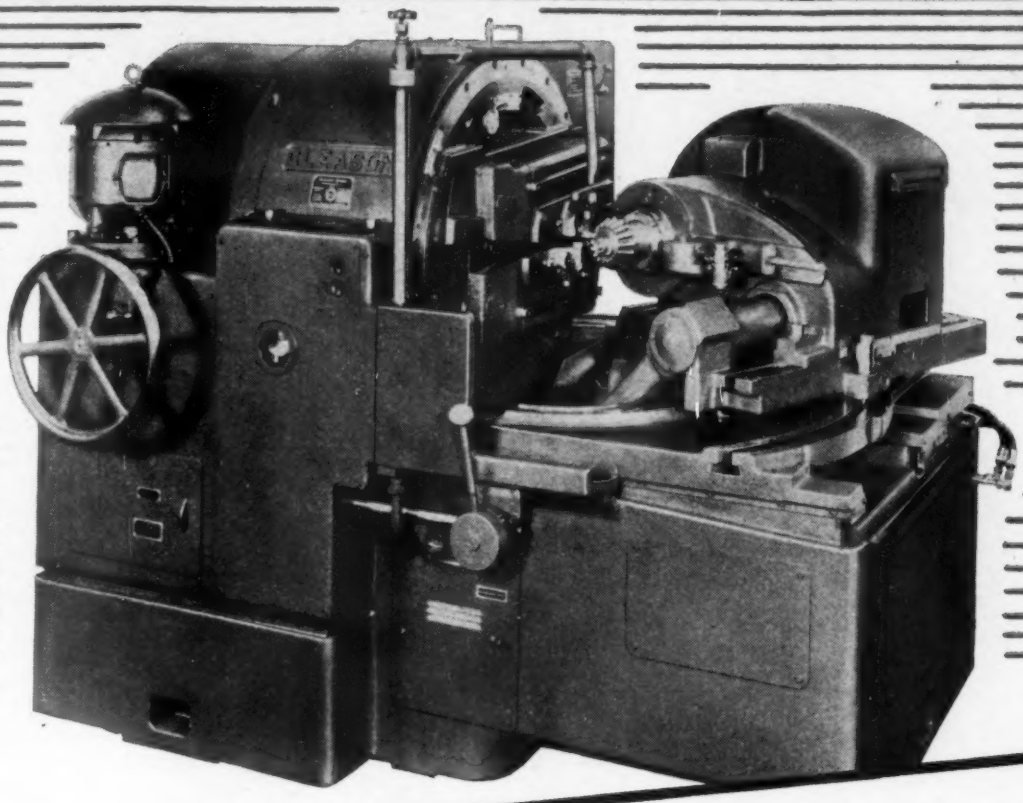
Coming . . . The first issue of the New Year will bring: A special report on hobbing dies for plastic molding, the start of a 2-part article on air gaging, more welding setups, suggestions for suggestion systems, shorter articles on involute sliding, tool control, upset forging, gage usage, press standardization, a miller guard, pictures of prison shop jobs, Short Cuts . . . with departments, about fourscore crowded pages.

Caution . . . If you want reprints of special reports, act now. Stocks vanish, with orders coming in like 1000 from Nela Park for Lighting, 500 from Standard Oil (Ind.) for Lubrication, 200 from Austin Co. for Air Conditioning, plus a steady stream of orders for one, two, five or 25 . . . Keeps our Suzie steppin' to get 'em sent.

FACT FINDER . . . Rupert Le Grand, author of several of the "How to Work . . ." series, and the special report on "Non-Destructive Testing Methods," is senior (in years of service) associate editor of *A.M.* During almost 19 years on the staff he has worked on all phases of producing our editorial content, including a 3-year sojourn in Detroit as resident editor. There he covered news and technical developments in automotive plants, also used it as a starting point for trips all over the Midwest and Canada. He was also Detroit Editor for *Business Week*. Now makes frequent return trips to put his skilled ear to the ground.

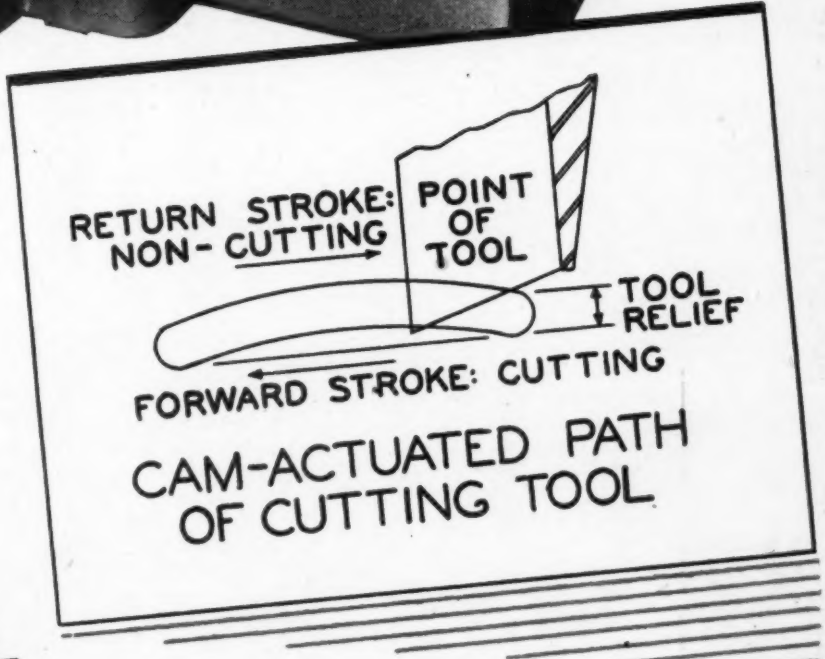
His degree of B.S.M.E. is from Newark College of Engrg., and the course included co-op machine shop and drafting at National Lockwasher and G.E. After graduation, he worked a year as a mechanical engineer on process and compound development for Congoleum-Nairn.

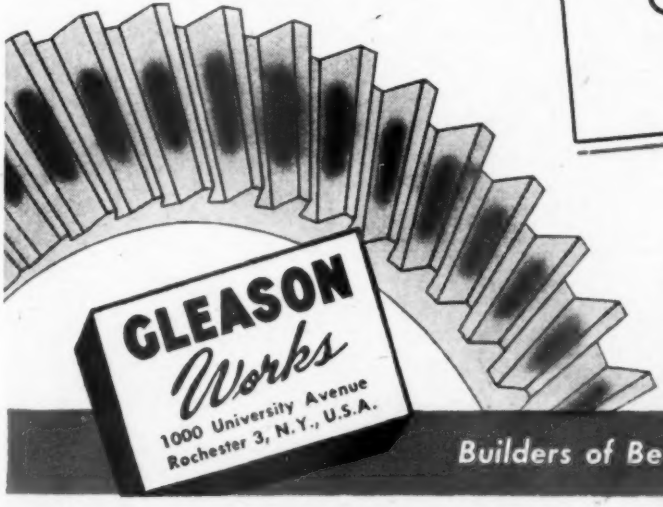
THE GLEASON BEVEL GEAR GENERATOR for CONIFLEX* GEARS



The latest Gleason Straight Bevel Generators in the intermediate (12" B Straight Bevel Generator illustrated) and large sizes incorporate such outstanding features as:

1. Localized tooth bearing* automatically cut into the gears.
2. Faster cutting made possible by its greater rigidity.
3. Ease of operation.





Coniflex gears have localized tooth bearing . . . accomplished by cam action during the cutting stroke and tool relief (withdrawal of the work on the return [non-cutting] stroke). Write for information on this new development in straight bevel gears.

Builders of Bevel Gear Machinery for Over Eighty Years

THE CINCINNATI MILLING MACHINE COMPANY

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CINCINNATI GRINDERS INCORPORATED

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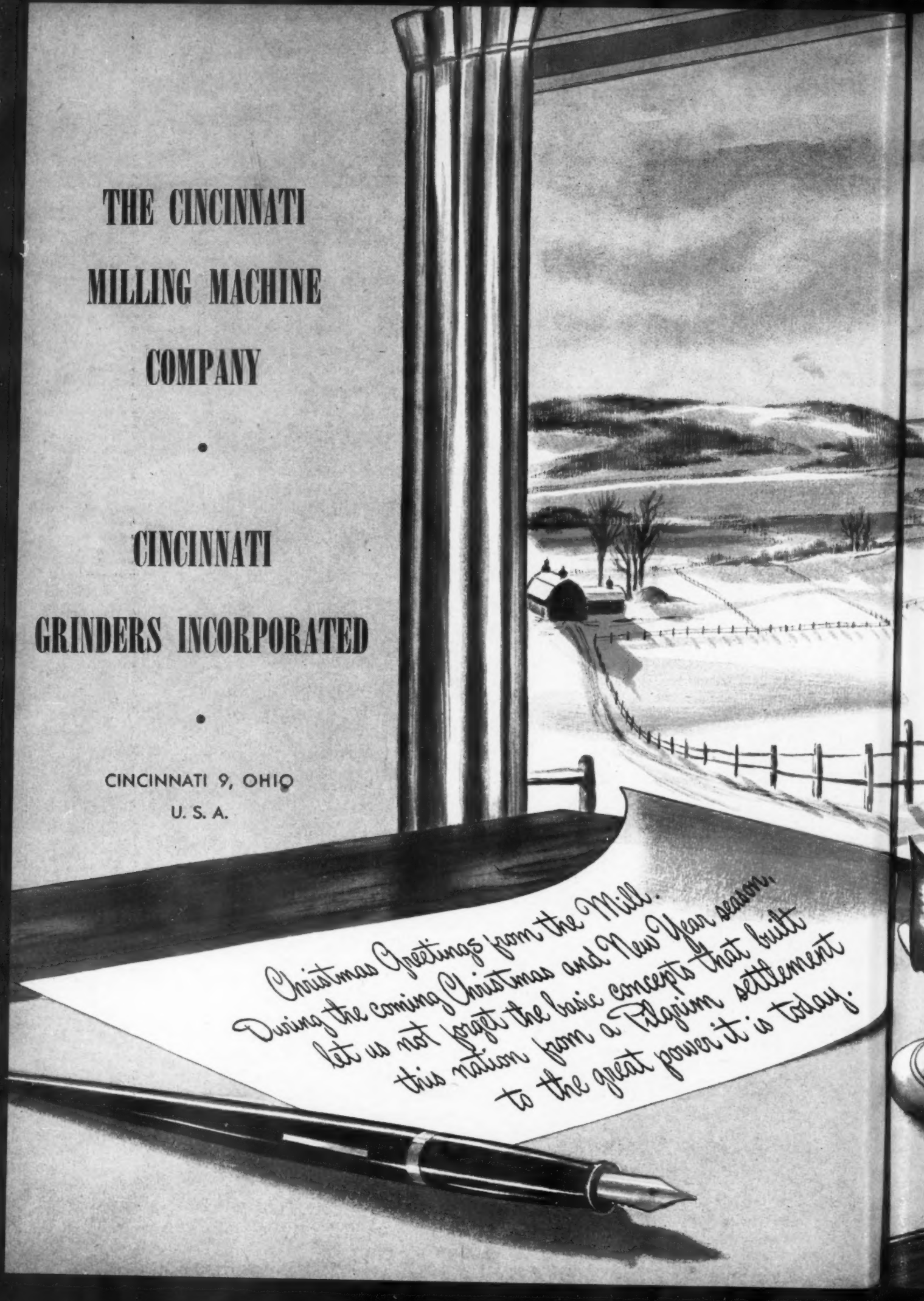
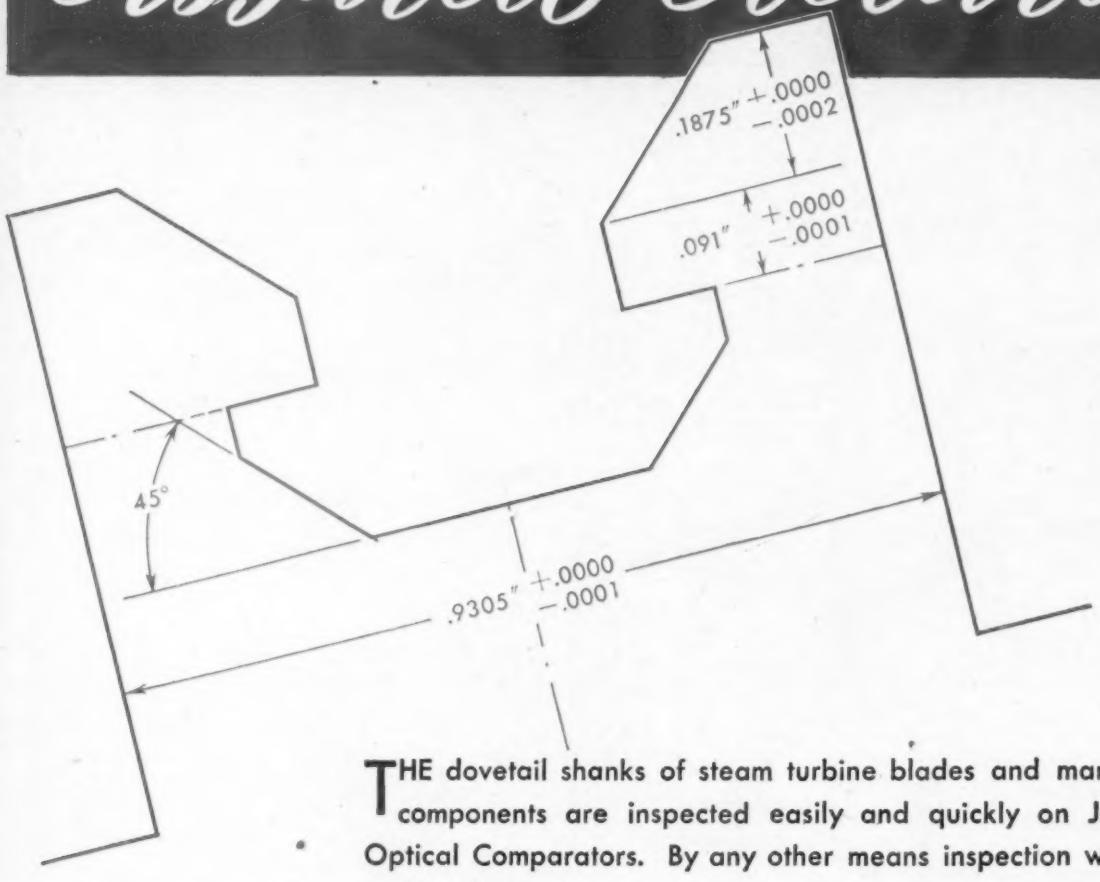
CINCINNATI 9, OHIO
U. S. A.


Christmas Greetings from the Mill.
During the coming Christmas and New Year season,
let us not forget the basic concepts that built
this nation from a Pilgrim settlement
to the great power it is today.

Assured Accuracy...



THE dovetail shanks of steam turbine blades and many other turbine components are inspected easily and quickly on Jones & Lamson Optical Comparators. By any other means inspection would be a slow and costly process.

Jones & Lamson Optical Comparators provide a rapid and extremely accurate method for inspecting even the most complex forms.

Our engineers are inspection specialists; their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

Beyond a SHADOW of a doubt

Probably a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.

PHOTOGRAPH
Courtesy The Elliott Company,
Jeannette, Pa.

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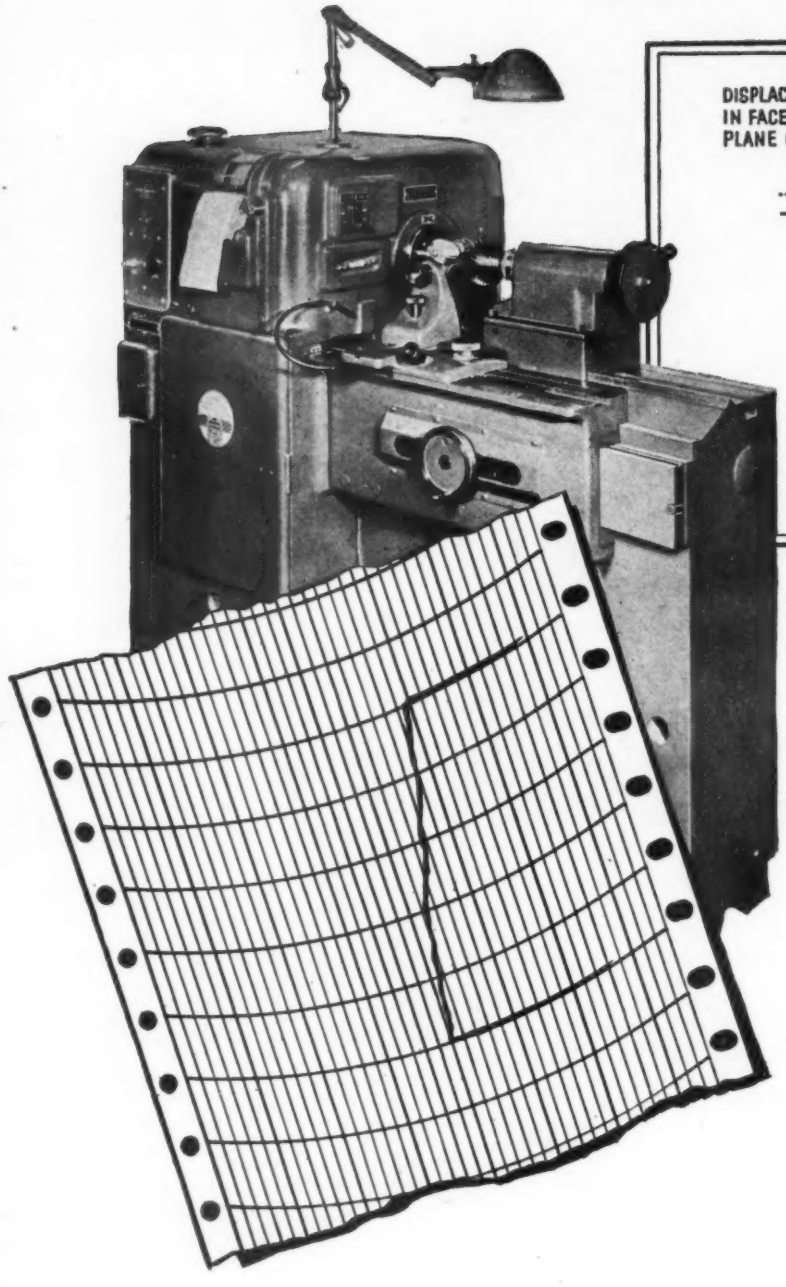
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

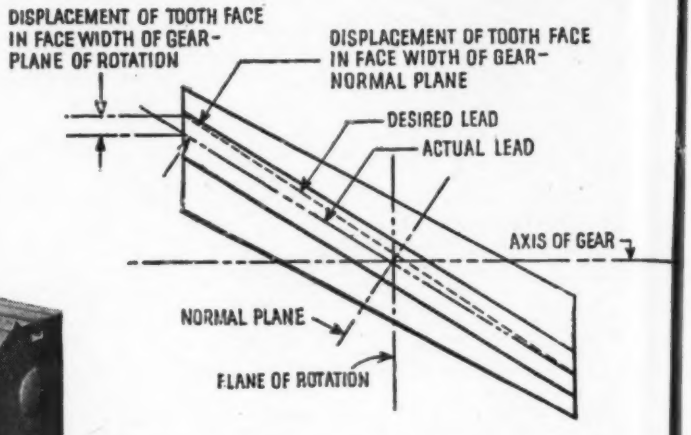
OPTICAL COMPARATORS

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

BENCH COMPARATOR WITH 14" DIAM. SCREEN & MEASURING ATTACHMENTS
STANDARD BENCH COMPARATOR
BENCH COMPARATOR 14" DIAM. SCREEN
DIRECT PROJECTION COMPARATOR
STANDARD PEDESTAL COMPARATOR
PEDESTAL COMPARATOR 30" DIAM. SCREEN

Now "LEAD" *Checking* Also




DISPLACEMENT OF TOOTH FACE IN FACE WIDTH OF GEAR - PLANE OF ROTATION
DISPLACEMENT OF TOOTH FACE IN FACE WIDTH OF GEAR - NORMAL PLANE
DESIRED LEAD
ACTUAL LEAD
AXIS OF GEAR
NORMAL PLANE
PLANE OF ROTATION

1. In Setting-up for Shaving, Lapping or Grinding

The critical need in gear finishing operations is to determine the amount of *"tooth displacement"*, if any, and the direction and amount of such tooth displacement. With data accurately recorded, the corrective adjustments in the angular setting of shaving tools, laps, or grinding machines, becomes a simple and easy matter.

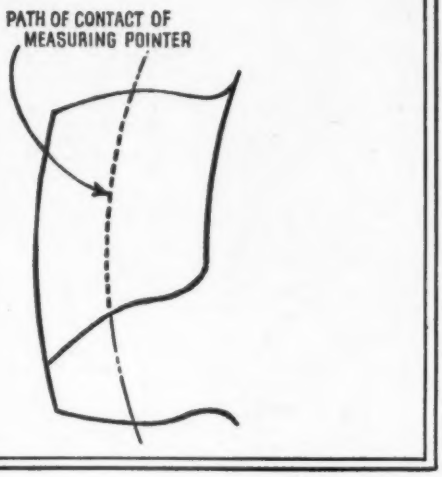
A basic function of the Fellows Lead Measur-

● **GOVERNMENT SURPLUS MACHINE TOOLS:** We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vt.; or our offices in Detroit, Mich. and Chicago, Ill.

THE FELLOWS METHOD...MACHINES AND TOOLS FOR AL

Comes Under Fellows

RECORDING INSTRUMENT CONTROL



ing Instrument is to provide just that information, in graphic chart form—with any departure from theoretical perfection magnified 500 times.

The accompanying diagram shows and identifies a typical tooth displacement error—and the chart alongside shows how that error is graphically charted where the space between each heavy ruled line represents 0.001".

Every shop manufacturing quality gears on a production basis will want complete information on this new and basic inspection device.

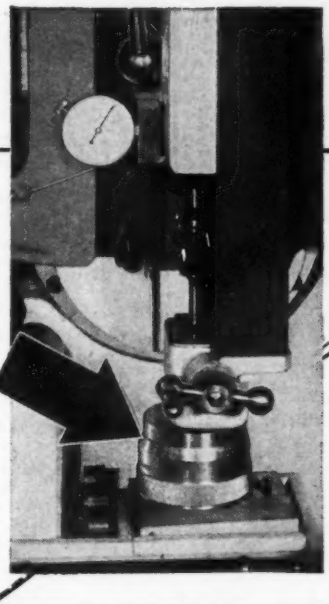
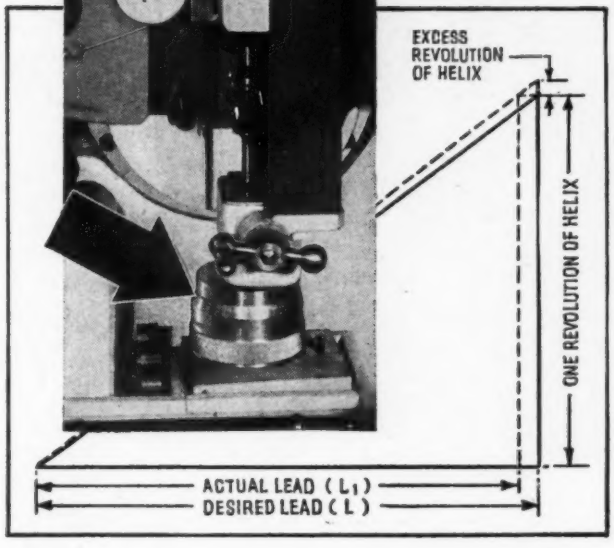


Photo shows a close up of the front slide and micrometer for setting.



2. In Checking Production Machines for "Lead" Accuracy

The Fellows Instrument functions quickly and easily, too, in determining the actual "lead" of a gear, and the amount of departure from the specified "lead". The departure from the required lead is simply obtained by a micrometer setting of the front slide which controls the rate of movement of the indicator slide relative to the rotation of the work. The micrometer gives direct readings in tenths of a thousandth, and this difference between the theoretical setting and the actual setting of the slide, when multiplied by a factor, gives the error in lead.

Fellows

Write for descriptive bulletin. The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit—or 640 West Town Office Bldg., Chicago.

FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

THIS PENNY SAVER
IS TOPS WITH OPERATORS

Left: Speed and Feed Change Lever. Just engage the lever and the gears shift by power. There's one at the front, and another at the rear working positions.

Right: Rough and finish milling one side of a fixture body. The operator saves time by changing speeds and feeds right where he stands—at the rear working position of his Dial Type Miller.

When you select a milling machine for a wide variety of work, don't overlook the basic considerations of low cost production. A penny saved here and there can build up to an impressive profit in your statement of operations. ¶ For example, take cutting speeds and feeds. In a variety of small lot milling operations, the correct speeds and feeds result in many small savings—sometimes big ones. And the CINCINNATI Dial Type method of selecting speeds and feeds—by power—is the most economical, yet the easiest. The operator doesn't have to walk a step, whether he's working at the front or behind the table. Because it's easy to change speeds and feeds, he keeps the machine working at top efficiency. And CINCINNATI Dial Type Milling Machines have many other features that contribute to low cost production. Catalog M-1499 gives you the complete story.

Above: Milling a slot in a steel bar. It's easy for this Dial Type operator to save time by increasing speeds and feeds for the finishing cut.

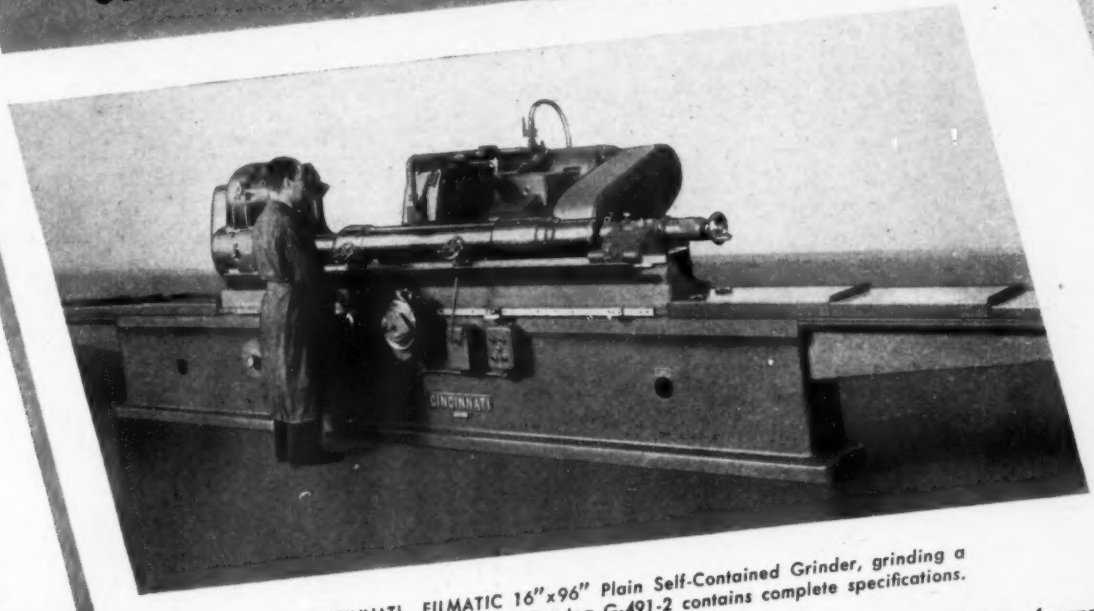
THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES

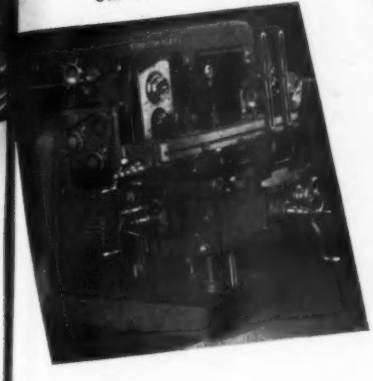
CINCINNATI

WHEN THE GOING IS TOUGH
YOU'LL REALLY APPRECIATE CINCINNATI FILMATIC GRINDERS



CINCINNATI FILMATIC 16"x96" Plain Self-Contained Grinder, grinding a Diesel locomotive axle. Catalog G-491-2 contains complete specifications.

CINCINNATI Dial Type Milling Machines are available in Nos. 2, 3 and 4; Plain, Universal (illustrated below) and Vertical styles; Medium or High Speed.



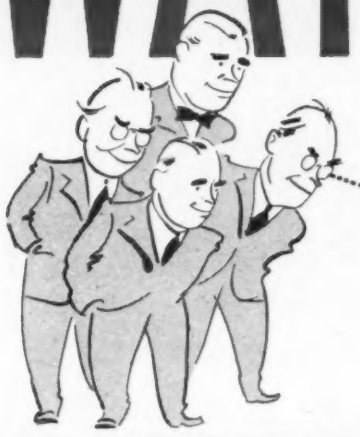
● Don't let stock allowance for grinding put you between the devil of scrap and the deep red sea of high costs. It's quite unnecessary, for there's no need to reduce the stock allowance to the danger point, especially on large parts like the 1200-pound Diesel engine shaft being ground on the machine illustrated above. There's a good reason for this statement. The machine, a CINCINNATI FILMATIC 16" Plain Self-Contained Grinder, is constructed for heavy precision work, and its spindle bearings will withstand the heaviest stock removal job you can assign to it. That's because they're FILMATIC—an exclusive CINCINNATI feature. The operator can rough grind rapidly, and then with no extra preparation whatever, he can obtain a high quality, accurate finish grind. ¶ Whether you are grinding, or turning and polishing large parts, examine the costs of finishing to accurate size. CINCINNATI FILMATIC Grinders will do the job faster, and save you money. Write for the complete FILMATIC story, contained in publication G-446.

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

ANY WAY YOU



VAN NORMAN

Ram Type Milling Machines

★ Are Easy to Operate
★ Cut Down Idle Time
★ Multiply Machine Output

From any point of view, management, production, or operator . . . Van Norman Ram Type Millers meet every milling requirement from accurate work to maximum production and economy.

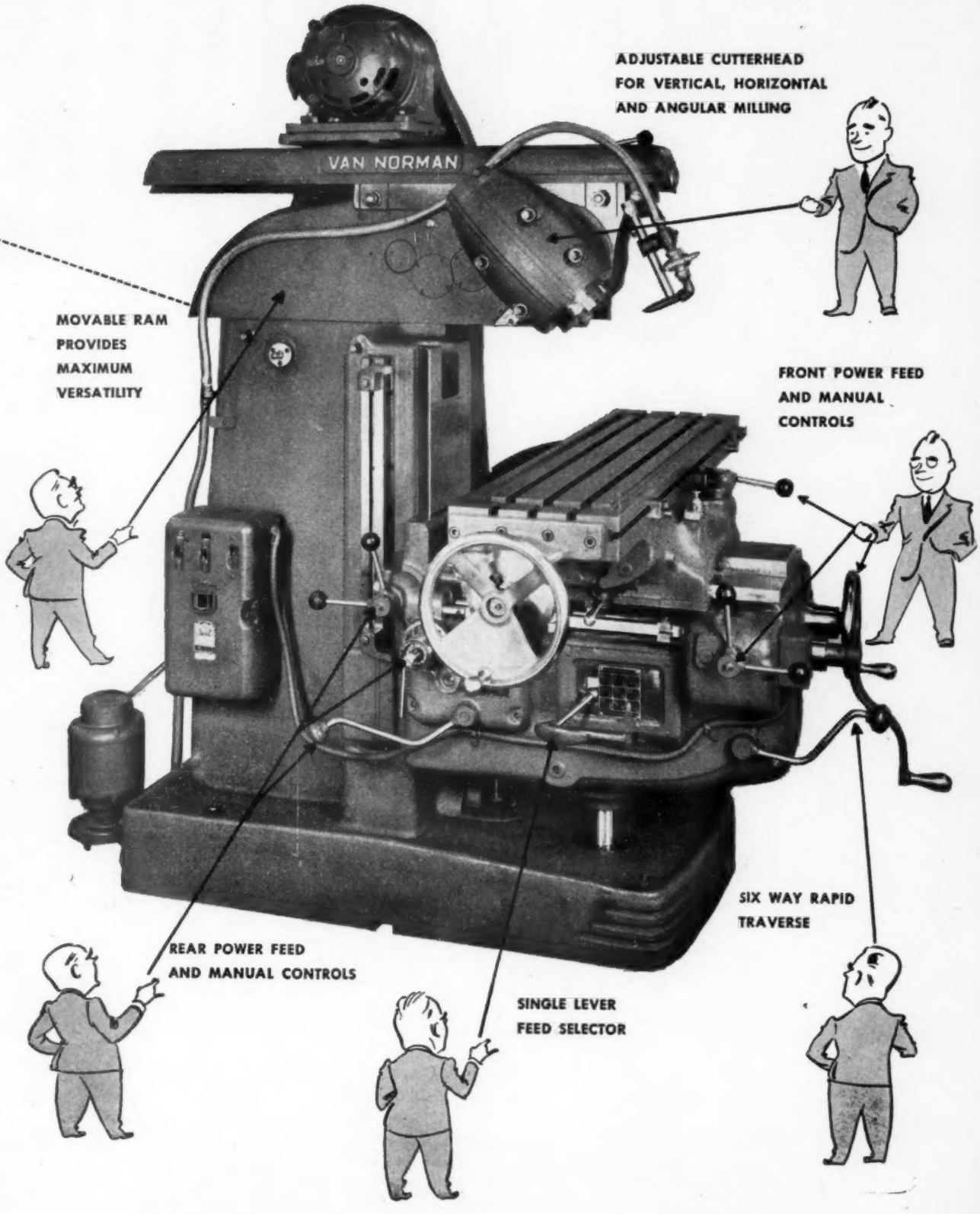
- *Adjustable Cutterhead* permits conventional horizontal and vertical as well as angular milling all on one machine . . . minimizes work setups . . . cuts idle machine time. In addition, this versatility enables you to meet job to job milling requirements.
- *Increased Range* — the adjustable cutterhead and movable ram provide maximum milling capacity and versatility.
- *Front and Rear Finger-tip Controls* of all power feeds, six way rapid traverse and hand adjustments provide extreme ease of control . . . reduce worker fatigue . . . increase output. Power controls operate in the desired table, saddle and knee movement assuring maximum simplicity of operation.
- *Single Lever Feed Selector* provides quick, easy selection of the proper feed for the type of work being milled. 18 feeds are instantly available from front or rear operating position.
- *Long Life Accuracy* is assured by precision Van Norman construction. Hardened alloy steel gears and multi-splined shafts operate on anti-friction bearings . . . automatic lubrication assures thorough oiling of all moving parts . . . massive knee, saddle and table assemblies provide rigidity.

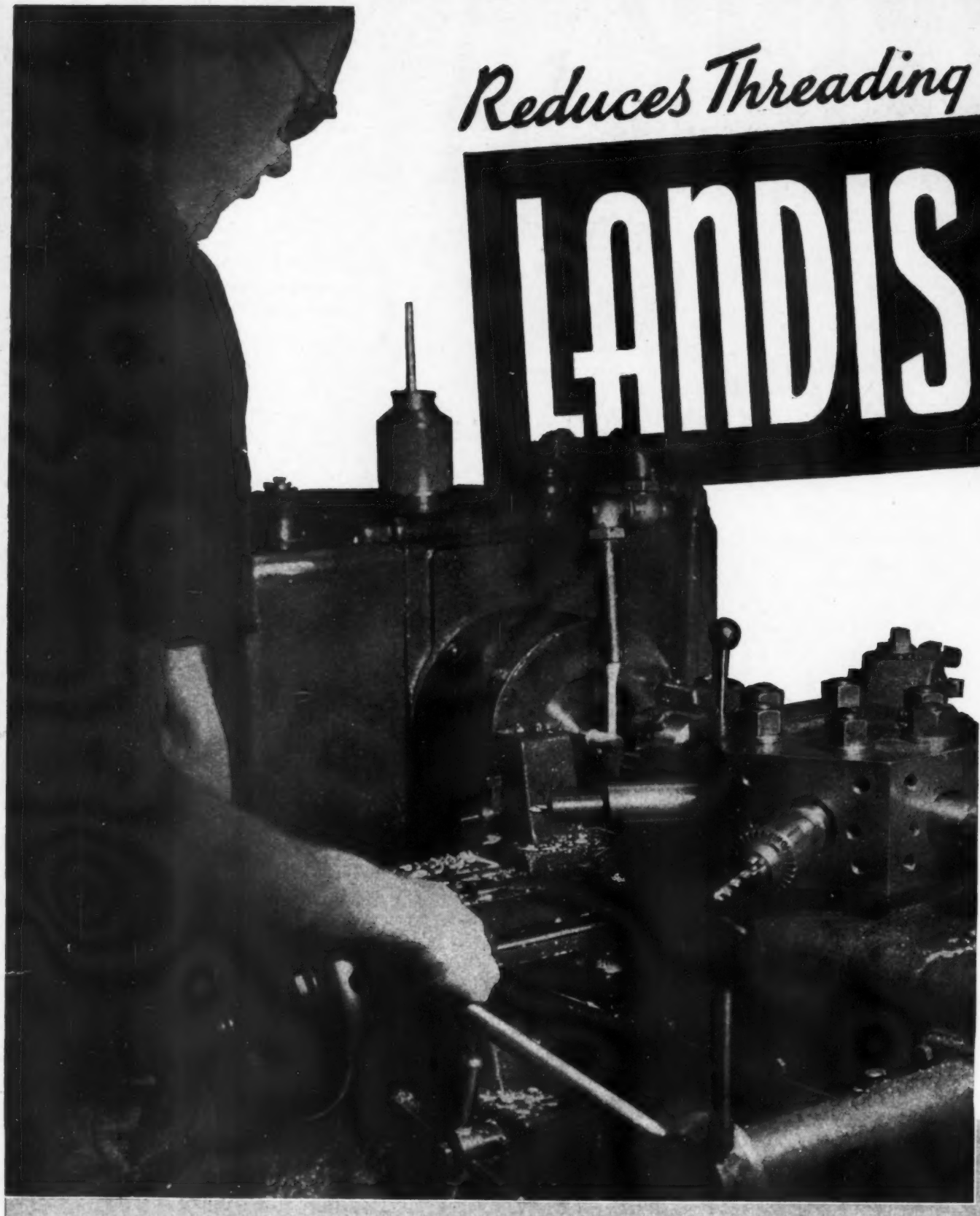
Investigate Van Norman Ram Type Millers today. They are available in many models and sizes, with plain or universal saddles, to meet every requirement for toolroom, laboratory, machine shop, pattern shop, and general purpose milling.

VAN NORMAN COMPANY
Springfield 7, Massachusetts

"It pays to Van Normanize"

LOOK AT IT...


VAN NORMAN
ADJUSTABLE CUTTERHEAD FOR VERTICAL, HORIZONTAL AND ANGULAR MILLING
MOVABLE RAM PROVIDES MAXIMUM VERSATILITY
FRONT POWER FEED AND MANUAL CONTROLS
SIX WAY RAPID TRAVERSE
REAR POWER FEED AND MANUAL CONTROLS
SINGLE LEVER FEED SELECTOR



Reduces Threading

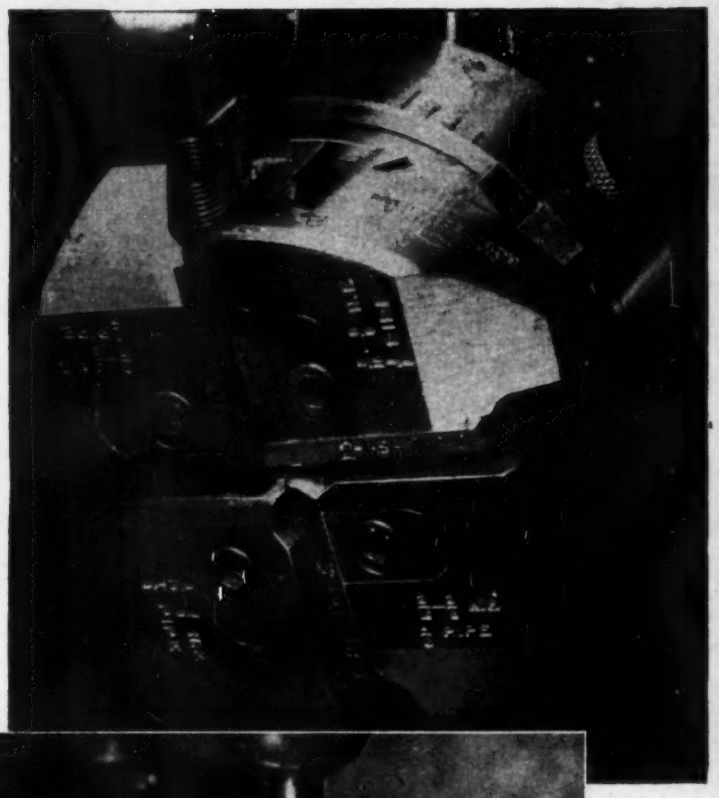
LANDIS

THREADING
AND ROLLING
MACHINES

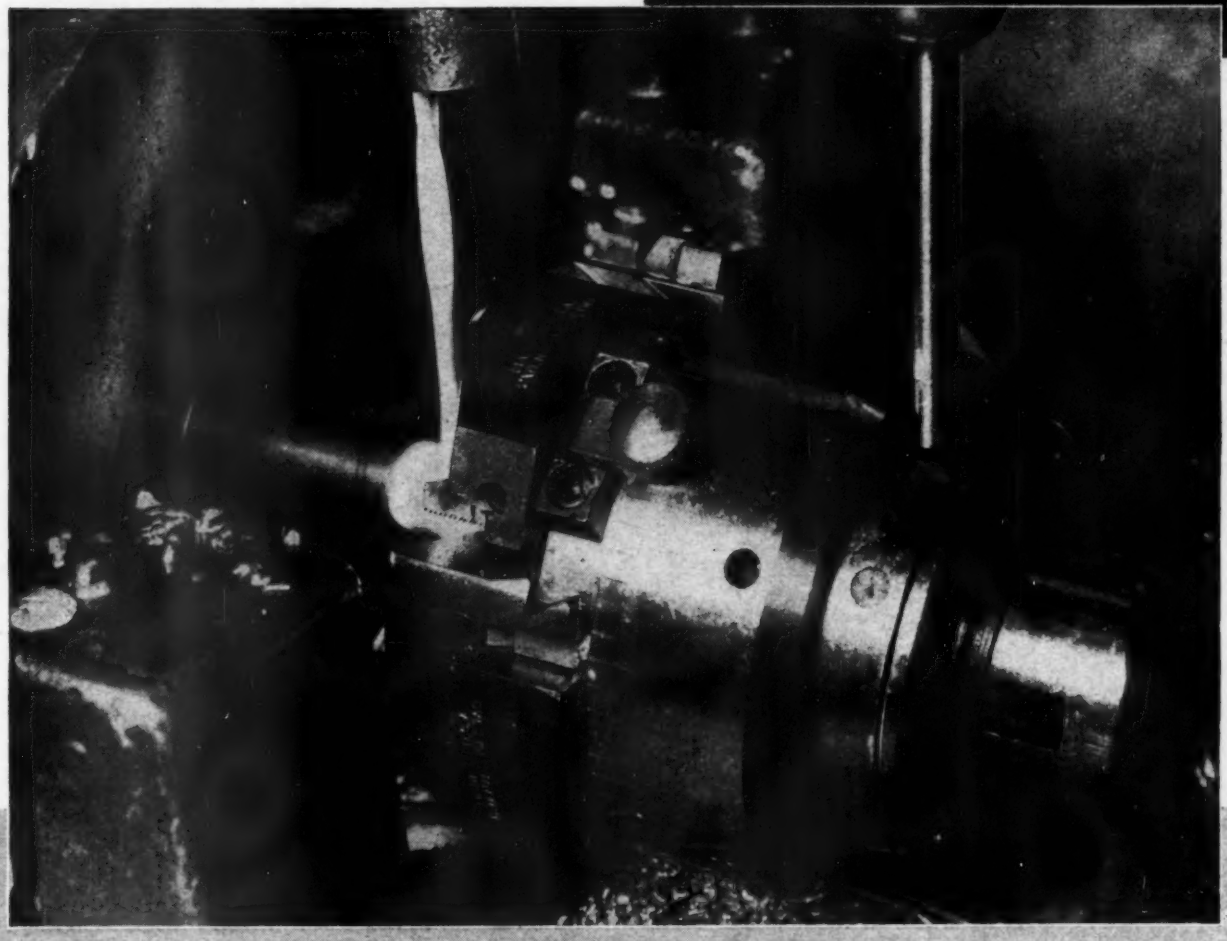
LANDIS
WAYNESBORO

Time and Cost

DIE-HEADS



Submit your threading problems to our engineers for recommendations.



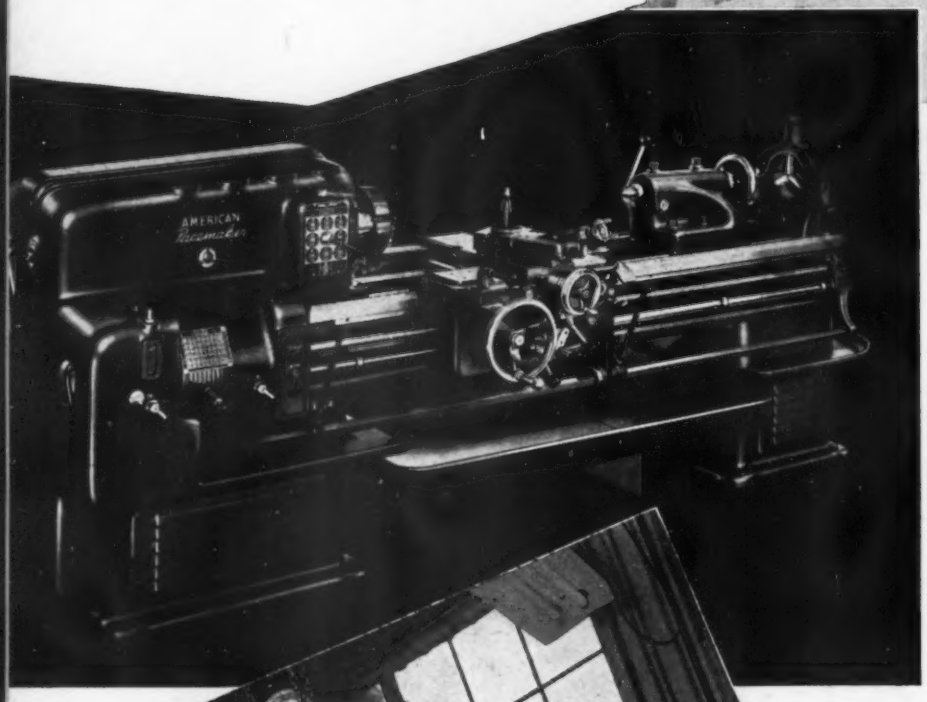
MACHINE CO.
PENNA., U. S. A.

DIE HEADS
TAPS · CHASERS
GRINDERS

Under the Palms at Miami

SERVES

to keep the "Flying Clippers"



Before installing their "Amer can" Lathe Pan American Wor Airways had to send their cran shafts back to the factory f repair. Now they do the j themselves in their own shop a tremendous saving in time an expense.

This "American" accepts th many miscellaneous jobs it called upon to do without a mu mur. Its power, range, ease handling and dependability ha made it a favorite in this sho

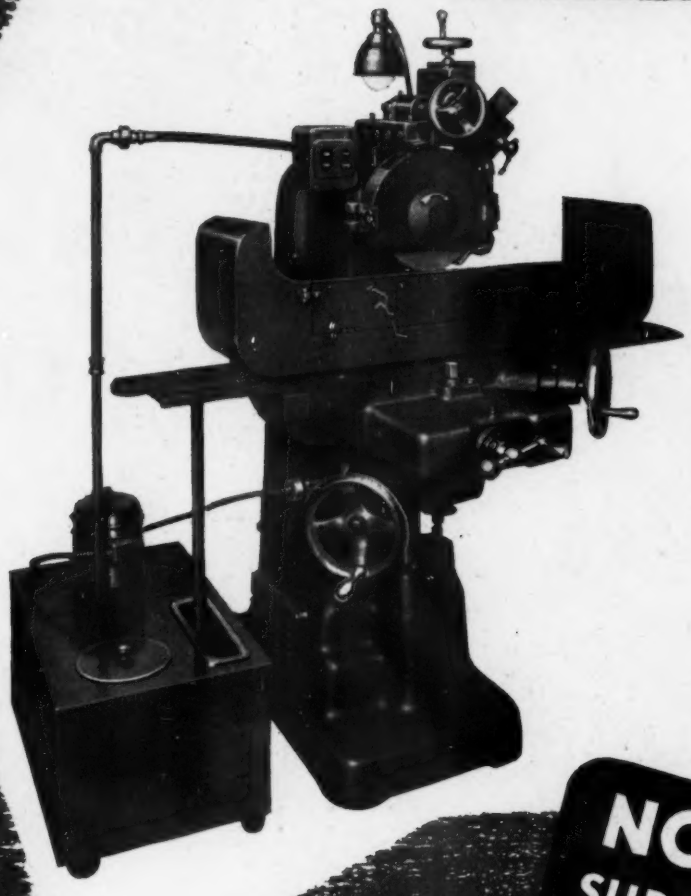
Bulletin No. 16 gives all the reasons

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

FOR LOWER UNIT COSTS...



- ★ Wide Range of Uses
- ★ Accurate Work
- ★ Quick Set-ups
- ★ Easy job-to-job Change-over

NO. 15 SURFACE GRINDER

For accurate production grinding of odd size pieces — for 101 toolroom jobs — the COVEL No. 15 is a versatile timesaver. Easy to operate and precise, yet rugged enough for long, hard use with minimum maintenance. A COVEL "best seller" — lowering job costs in thousands of plants. Table has 6″ x 18″ working surface, transverse travel, 7½″, vertical travel, 11″, adaptable for wet or dry grinding. Investigate today.

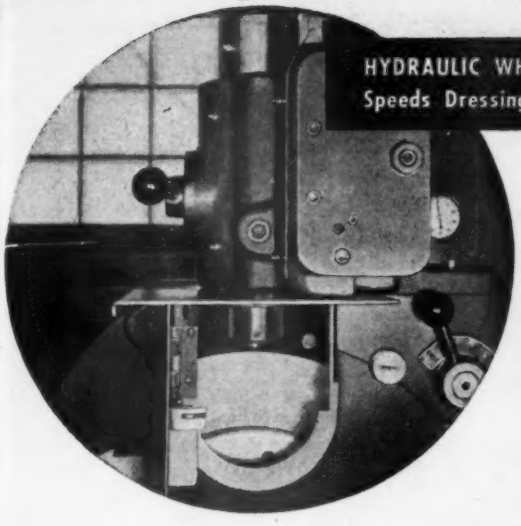
Write for complete details in this bulletin A-266 — or see your nearest COVEL Dealer.

COVEL MANUFACTURING CO.
BENTON HARBOR, MICHIGAN, U.S.A.

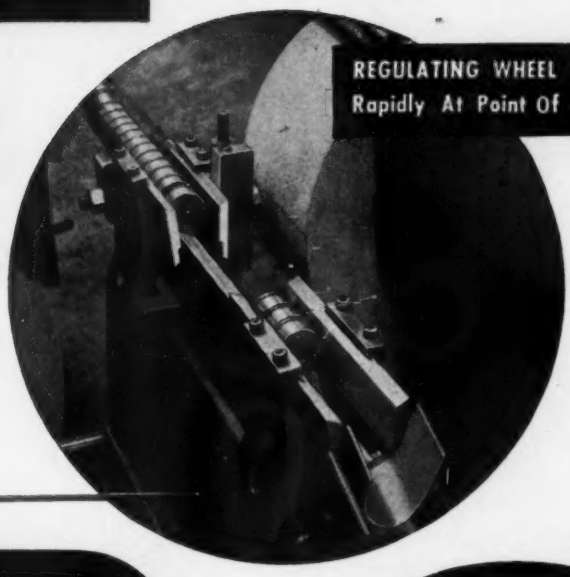
COVEL
INDUSTRIAL GRINDERS

LANDIS TOOL
Precision Grinders

Request Catalog T-44 for details



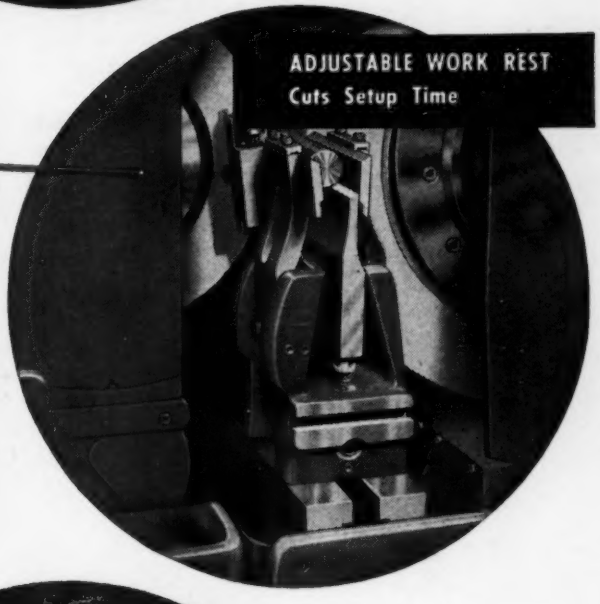
HYDRAULIC WHEEL DRESSER
Speeds Dressing



REGULATING WHEEL Dressed
Rapidly At Point Of Contact

LANDIS TOOL

Centerless Grinder Design Features for *high Production* and *easy Maintenance*



ADJUSTABLE WORK REST
Cuts Setup Time

ACCESSIBLE OPERATING PARTS
Simplify Maintenance

CENTRALIZED CONTROLS
Reduce Fatigue

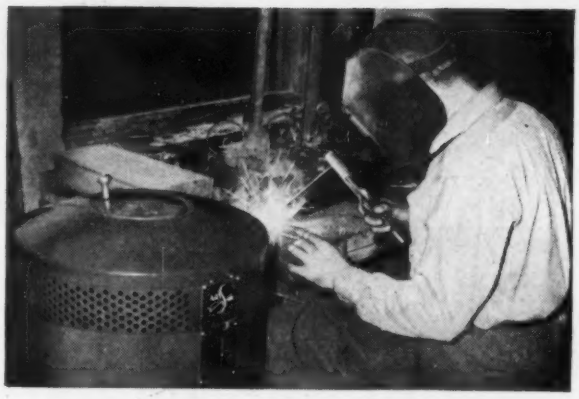
61

LANDIS TOOL COMPANY, WAYNESBORO, PENNA.

"Caterpillar"· H.Wolter

Both use SMITHway *Certified* Electrodes

H.WOLTER and SONS, 14 North Loomis St., Chicago, manufacturers of metal goods for churches and religious institutions, know the practical value of A. O. Smith welding research. For all small work, no less than for the "big stuff," SMITHway Electrodes take the chance out of welding, make it the modern tool for *all* kinds of jobs and shops.



Welding church candlestick holders in H. Wolter and Sons shop

CATERPILLAR TRACTOR COMPANY, Peoria, Ill., one of the world's largest manufacturers of tractors for farm and industry, bulldozers, and other earth-moving machinery, employs SMITHway Electrodes for many production operations. Like manufacturers everywhere, "Caterpillar" knows the proof of SMITHway Electrodes is in production—and in *service.*

"Caterpillar" Diesel D7 tractor

SMITHway *Certified* Welding Electrodes—Made *by* Welders...*for* Welders

Through Leading Distributors Everywhere

SMITHway A. C. WELDERS

Six models, including 3 new models of 150-, 200-, and 250-ampere capacity. Heavy-duty models: 300-, 400-, 500-ampere capacity. Write for specifications and prices.

A. O. SMITH Corporation

NEW YORK 17 • PHILADELPHIA 5 • PITTSBURGH 19 • CLEVELAND 4 • ATLANTA 3
CHICAGO 4 • TULSA 3 • MIDLAND 5 • DALLAS 1 • HOUSTON 2 • NEW ORLEANS 18
SEATTLE 1 • SAN FRANCISCO 4 • LOS ANGELES 14
INTERNATIONAL DIVISION: MILWAUKEE 1

How to Dress Radii . . . . Angles Tangent to Radii

to .0001" Accuracy

The VINCO B-1 DRESSER — the most accurate formed wheel dresser available. Investigate this tool at your earliest opportunity.

The VINCO B-1 DRESSER, the most accurate tool of its kind, will dress forms on grinding wheels to an accuracy of .0001", quickly and easily.

We know you don't require such gage tolerances on your grinding wheels every day in the year, but, when you ARE faced with an exacting dressing job you can handle it with confidence if you use a VINCO B-1 DRESSER. And don't think you should use it only on specials. The VINCO B-1 DRESSER is built so sturdily that it can take constant usage for a long, long time and still keep its built-in accuracy.

Equipped with the standard diamond tool, it will dress convex radii up to 2½" and full 180° concave radii from 2-3/32" up. The half-circle attachment permits the dressing of full 180° concave radii from 1/16" to 2½". The dresser rotates on a precision bearing. The index plate is graduated in degrees and may be set to within ten minutes on the vernier. A free-floating clamp rigidly locks the index plate without distortion and without disturbing the radius setting. The dresser can be used on all surface grinders, and sub-bases (at slight additional cost) adapt it for use on most types of grinders.

MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Plain Cylindrical Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

The NORTON 4" Type C...

A PRECISION MACHINE

Designed for Grinding Small Work...

- **Electronically-controlled variable work speed drive over a wide range.**
- **Compact controls and adjustments conveniently located for maximum operating convenience.**
- **Time-wasting hand motions eliminated by interrelated automatic controls.**
- **Hydraulic table traverse — hydraulic power rapid traverse of wheel slide — two-speed hand table traverse — grinding wheel reciprocation.**

The Norton 4" Type is a grinder that can turn out small cylindrical work to extremely high accuracy standards at an extremely high production rate. A new catalog—Form 287—gives complete details.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

M-519

NORTON GRINDERS *and Lappers*

"THE STORY OF THE TWIST DRILL IS THE STORY OF MORSE"

Aborigine with Shaft Drill

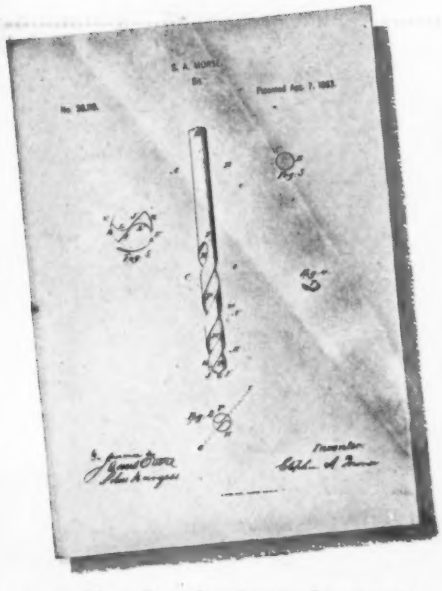
Egyptian with Bow Drill

Chinaman with Pump Drill

For Many Centuries They Drilled It the "HARD WAY" ...until

STEPHEN A. MORSE

Put his New Twist onto the old flat Drill



Signed and witnessed patent drawing of first Morse Twist Drill.

It was a long way from the aboriginal drill to the original Morse Twist Drill. All the way from a prehistoric cave to Bridgewater, Massachusetts . . . where Steve Morse patented his invention in 1863.

At first, all Morse Twist Drills were carbon steel, hand-cleared. Then high-speed steels were tried . . . *and forged* . . . and the Morse Drill won new users by the thousands. Meanwhile, groove-area and twist-cut angle were changed to step up speeds and feeds . . . and drills with oil-holes were developed for deep drilling. Next came cobalt steel drills for hard materials . . . drills tipped with tungsten carbide . . . and drills specially treated for abrasion resistance.

Then, as Morse development sped ahead, came standard and special drills for hard rubber, slate, plastics, brass, steel (including manganese) light metals, wood, paper. Today, whatever your drilling job, you can get exactly the Morse Twist Drill you need to do that job with highest speed and accuracy, at lowest cost. Ask your Industrial Supply Distributor, *now*, to get you a Morse specification . . . and count yourself in on all the benefits of Morse's steady advance in twist-drill development.

Workman of 1862
with Flat Drill

In only 83 years (from the time of the old flat drill) Morse development has ranged from the patenting of the milled twist drill to the modern, high-precision, long-lived High-Speed Drill.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

MORSE TWIST DRILL & MACHINE COMPANY

The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

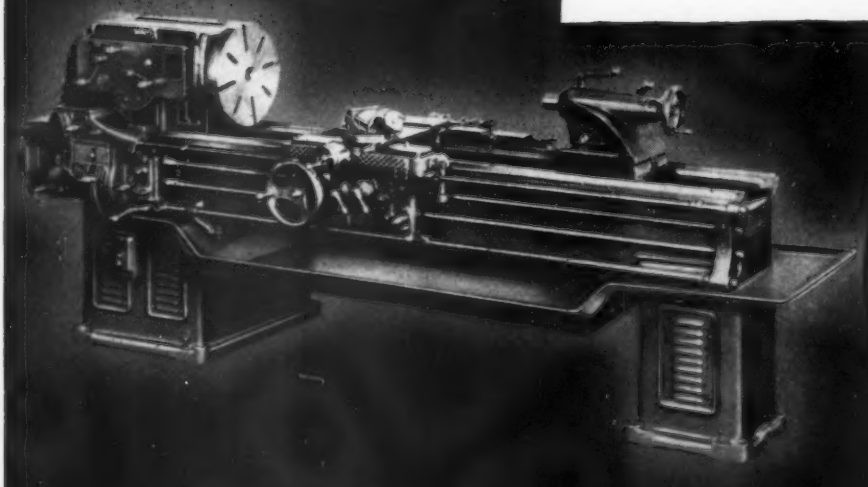
"A house is no stronger than its foundation"
—AND A LATHE IS NO STRONGER THAN ITS BASE

Sidney Lathes

● Provide an exceptionally sturdy bed design with four longitudinal walls with cross girts at close intervals. This construction assures accuracy under heavy cuts and resists deflections and twisting strains. Actual tests also prove it much superior to the conventional two-wall construction.

The bed is cast of a semi-steel nickel mixture which gives the ways a close grained, hard bearing surface. Hardened and ground tool steel ways can be furnished with this bed. Furnished with each lathe is a copy of the final test with detailed accuracies and alignments.

Bulletins on all sizes available.



Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904

HARDINGE
ELMIRA, N.Y.

High Speed Precision Tool Room Lathe

SAVES TIME . . . SAVES MONEY

Time and money can be saved when tool room collet work of one-inch diameter or less is not done on heavy lathes. Here is how:

SAVE TIME — by avoiding use of slower machines designed to produce large work.

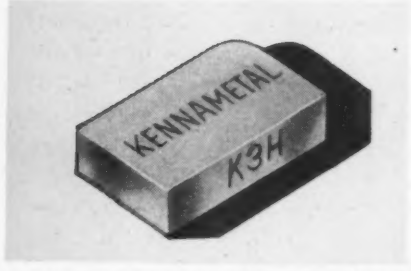
SAVE MONEY — by prevention of under-capacity production on more expensive machines which consume excess power and waste floor space for size of work involved.

HARDINGE High Speed Precision Tool Room Lathes can save both time and money and return profits proportionate to machine investment, because it is the proper size tool room lathe for collet work one-inch or less. Furthermore, HARDINGE assures extreme accuracy, high spinale speeds and ease of operation.

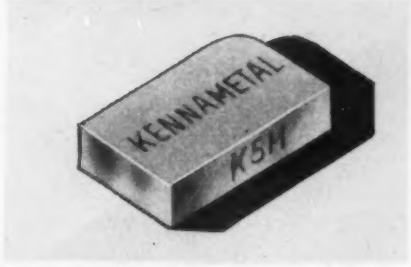
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

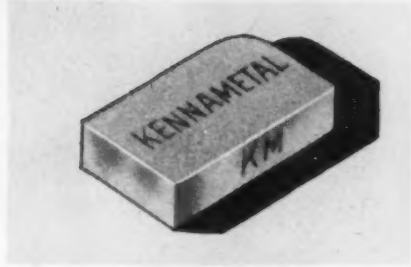
IT PAYS TO KNOW *Your* KENNAMETAL GRADES!



Most crater-resistant Kennametal tool material—gives outstanding service for finishing or moderate cuts on carbon and alloy steels .30% carbon and higher. Also time-and money-saver for general use on soft steels containing less than .30% carbon, precision boring of steel where .004" feed or over is used, and for many milling jobs on steel. 92 Rockwell A hardness.

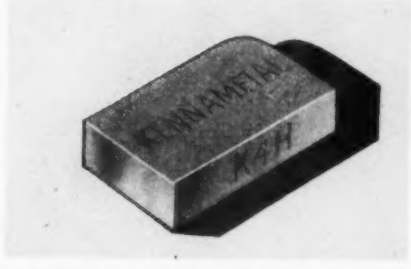


The hardest Kennametal tool material grade — specifically for solid tools used on precision boring of steel parts. Its high hardness, great resistance to cratering, and unusual strength can help you cut costs where fast, accurate work is essential. 93.2 Rockwell A hardness.



Strongest crater-resistant Kennametal tool material—saves tooling and production costs when taking rough cuts on carbon and alloy steel forgings, bar stock, etc., having carbon content of .30% and higher. Also outstanding for milling of steel at heavy chip loads. 91 Rockwell A hardness.

A very strong Kennametal tool material, particularly suitable for roughing cuts on steel castings. Its high resistance to abrasion and edge wear of sand inclusions makes possible exceptionally high rate production, and economical tooling costs. 91.5 Rockwell A hardness.



Highly resistant to edge wear—takes a good edge—a money-saving tool material for very light finishing cuts on steel and for precision boring with less than .004" feed. Ideally suited for tools requiring large nose radius or where tool must dwell without cutting. Excellent for milling, and very rough cutting of brass, bronze, and aluminum alloys. 92.3 Rockwell A hardness.

Reduces cost of machining cast iron. Extremely hard, straight tungsten carbide tool material having unusual strength. Holds keen edge, withstanding shock of interrupted cuts on rough, sandy, or chilled castings. Also outstanding for finishing and precision boring of cast iron. 92.2 Rockwell A hardness.

KENNAMETAL Blanks are now sold in *Economical* "Package Lots."
For Prices and Particulars Send for Catalog 46

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

The CONE AUTOMATIC MACHINE COMPANY
sees many
GOOD THINGS AHEAD

It is reported that . . . . . .

Westinghouse calls its new steel encased motor the most revolutionary change in construction in 58 years and states that it delivers up to 134% more power per pound than previous motors.

get ready with CONE for tomorrow

Federal Telephone and Radio Corporation will conduct experiments with television, FM and radar in a building at Nutley, N.J., which will be completely shielded from atmospheric electricity.

be ready with CONE for today

Called the world's largest, a spot welder that can make 48 welds at a single stroke is in use at Pullman-Standard Car Manufacturing Co.

get ready with CONE for tomorrow

A division of Reynolds Metals Company has a new line of all-aluminum bicycles and scooters.

be ready with CONE for today

Raytheon Mfg. Co. has an electronic kitchen range. The food is put in a disposable dish and quickly cooked by the energy from a magnetron tube.

get ready with CONE for tomorrow

Bell Telephone Laboratories report that they have developed a tube that will send a hundred million words per minute by telegraph.

be ready with CONE for today

The Army Air Force has contracted with Fairchild Engine and Airplane Co. for fundamental research in the use of atomic energy in aircraft.

get ready with CONE for tomorrow

Aluminum Co. of America has recently supplied a 100-foot all-aluminum span for a railroad bridge at Massena, New York.

The Souhegan Mills of Wilton, N. H., believes that its molded board, made of shavings, can compete in price and utility with plywood or lumber.

be ready with CONE for today

The U. S. Bureau of Mines finds that Freon II is more effective in fighting gasoline fires than any of the other gases tested.

get ready with CONE for tomorrow

Patent 2,404,206 has been granted for a method of mining practically pure copper by dissolving it chemically and accumulating it electrolytically.

be ready with CONE for today

Nylon drive ropes are said by Plymouth Cordage Company to reduce machine shut-downs.

The behavior of piston rings and oil films has been studied by the National Advisory Committee for Aeronautics by using a glass engine cylinder.

get ready with CONE for tomorrow

When their new 2-million volt machine is installed, Babcock and Wilcox Co. will have 12 X-ray machines in use for checking steam generating equipment.

be ready with CONE for today

Blaw-Knox has built two 23-cubic yard clamshell buckets for unloading coal on Lake Superior. They weigh nearly 14 tons apiece and are believed to be the largest of their kind.

get ready with CONE for tomorrow

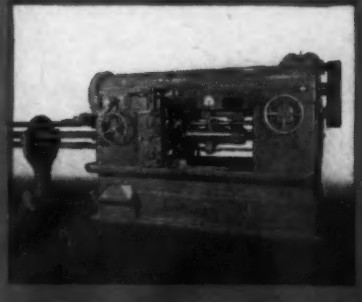
Scientific American prophesies that the use of silicones will bring about a revolution in surface finishes comparable to that resulting from the development of nitrocellulose lacquers.

FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

Give soft jobs to
any Automatic

put the *tough* ones on a CONE

From 65 mm 3312 stock, a 2⅝" Six Spindle Conomatic, with 13 HSS tools, produces the part shown here in 71 seconds.



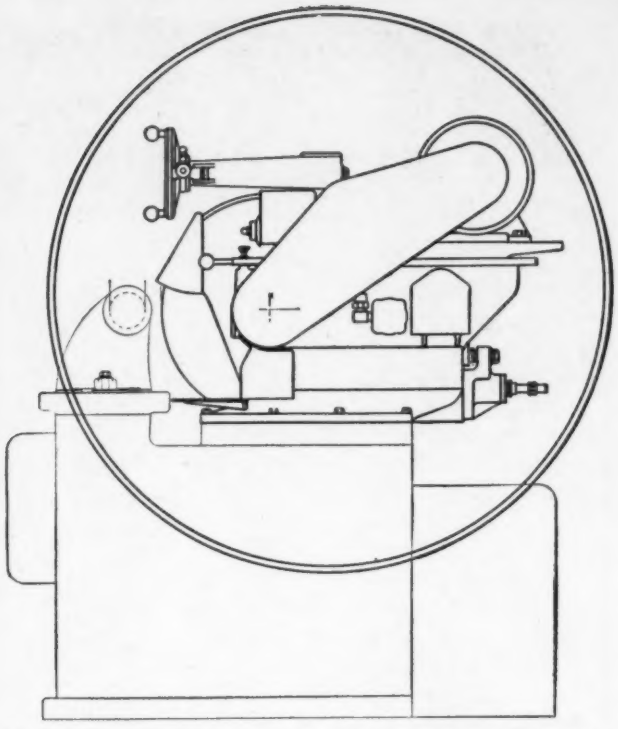
Ask your CONE *representative to show you our new color motion picture*

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

36

You too can have FITCHBURG *Automatic* PRECISION GRINDING *INEXPENSIVELY*...

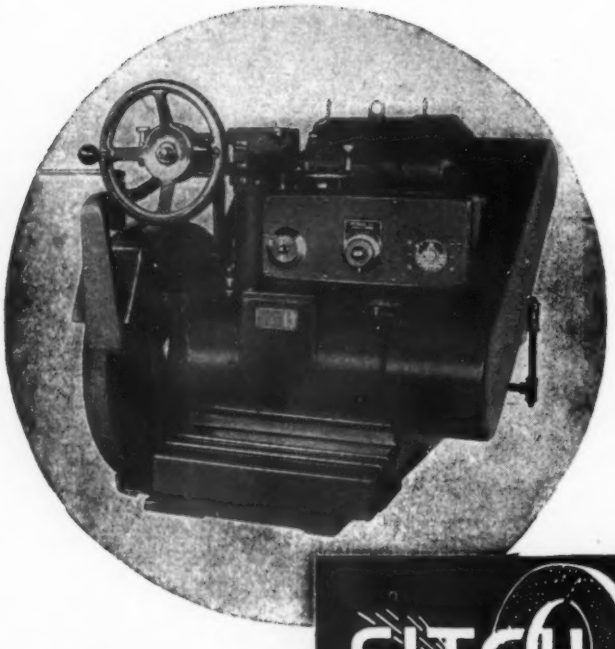


FITCHBURG Bowgage Head mounted on another make of grinding machine

by installing FITCHBURG Bowgage Heads on the Grinders you now have.

Just as we did in the above case—and in many others—we'll be glad *to prove to your satisfaction* the ease, the simplicity, and the *inexpensiveness* of installing Fitchburg Bowgage Heads on your present grinders. With your grinding equipment thus modernized, the resulting mass production applied to your precision grinding will soon pay off the small cost involved.

The FITCHBURG Bowgage Head is a self-contained grinding unit, with *all* its movements and controls within itself. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position—all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed—thus protecting your investment in grinding machinery. Fitchburg engineers will welcome the opportunity to help you solve your grinding modernization problem. There is, of course, no charge for this service. Send us the details—blueprints if available—and see how easily and inexpensively *you too* can have FITCHBURG AUTOMATIC PRECISION GRINDING in your shop.



FITCHBURG BOWGAGE HEAD

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders.

ARMSTRONG

More ARMSTRONG TOOL HOLDERS for *More* Profit

Whenever you tool a new operation with the correct ARMSTRONG TOOL HOLDER, you increase your profit. Each has the extra efficiency resulting from over 50 years of continuous development and refinement in designs; the extra strength resulting from modern metallurgy and manufacturing methods.

With ARMSTRONG TOOL HOLDERS you can take advantage of the new high speeds and heavier feeds of the newer cutting materials, without revolutionary changes or costly experimentation. They are the most profitable tools obtainable; the lowest in initial cost, the longest in service and most economical in use, for all incorporate the basic Armstrong Principle of small interchangeable cutter-bits in permanent drop forged shanks. They are the most readily obtainable tools too, for they are stocked by all leading distributors.

With emergencies, restrictions and controls passing, now is the time to tool up for normal business with more ARMSTRONG TOOL HOLDERS, for more profit.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. FRANCISCO AVE. CHICAGO 12, U.S.A.

Eastern Whse. & Sales Office: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. & Sales Office: 1275 Mission St., San Francisco 3, California

Ideal Live Centers are being used in this railway shop for (1) Machining Stem for Locomotive-tank Water Indicator (Illustrated), (2) Precision-Machining a Locomotive Guide Bolt, (3) Making Mandrel for turning a 11" Dia. Air Pump Piston.

Pictured here is a machine in the shop of a Trunk Line Railway, on which output has been stepped up 20%, and "Hot Center" delays and damage prevented by the use of IDEAL Live Centers.

Continuous operation is just as important here as on a production line. Every job in this shop is considered "rush" because needed to keep revenue-producing locomotives in service. The performance of IDEAL Live Centers is reported "highly satisfactory in speeding up work, preventing spoilage."

With IDEAL Live Centers, machines turn heavier loads, make deeper cuts, or turn at higher speeds.

IDEAL LIVE CENTERS

- Center turns with the work
- No friction between work and center
- Turn on ball and roller bearings
- Precision design and workmanship assure accuracy
- All parts hardened and ground
- Withstand heaviest loads

IDEAL *"Multi-Duty"* Live Center has four interchangeable inserts for all centered and uncentered jobs. 1 to 5 Morse Taper.

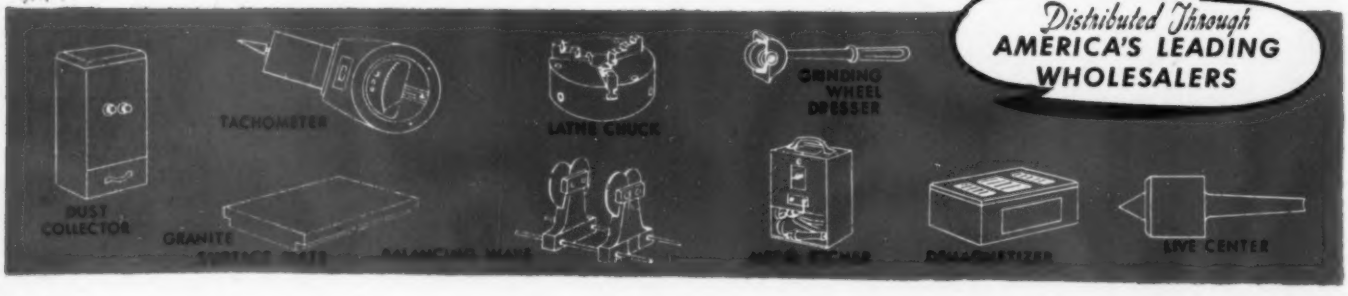
IDEAL *"Heavy-Duty" Model* — 9,000 lbs. radial load — 13,250 lbs. thrust load at 100 rpm. Eccentricity tolerance — .0000" to .0005"; 4, 5, 6, 7 Morse Taper.

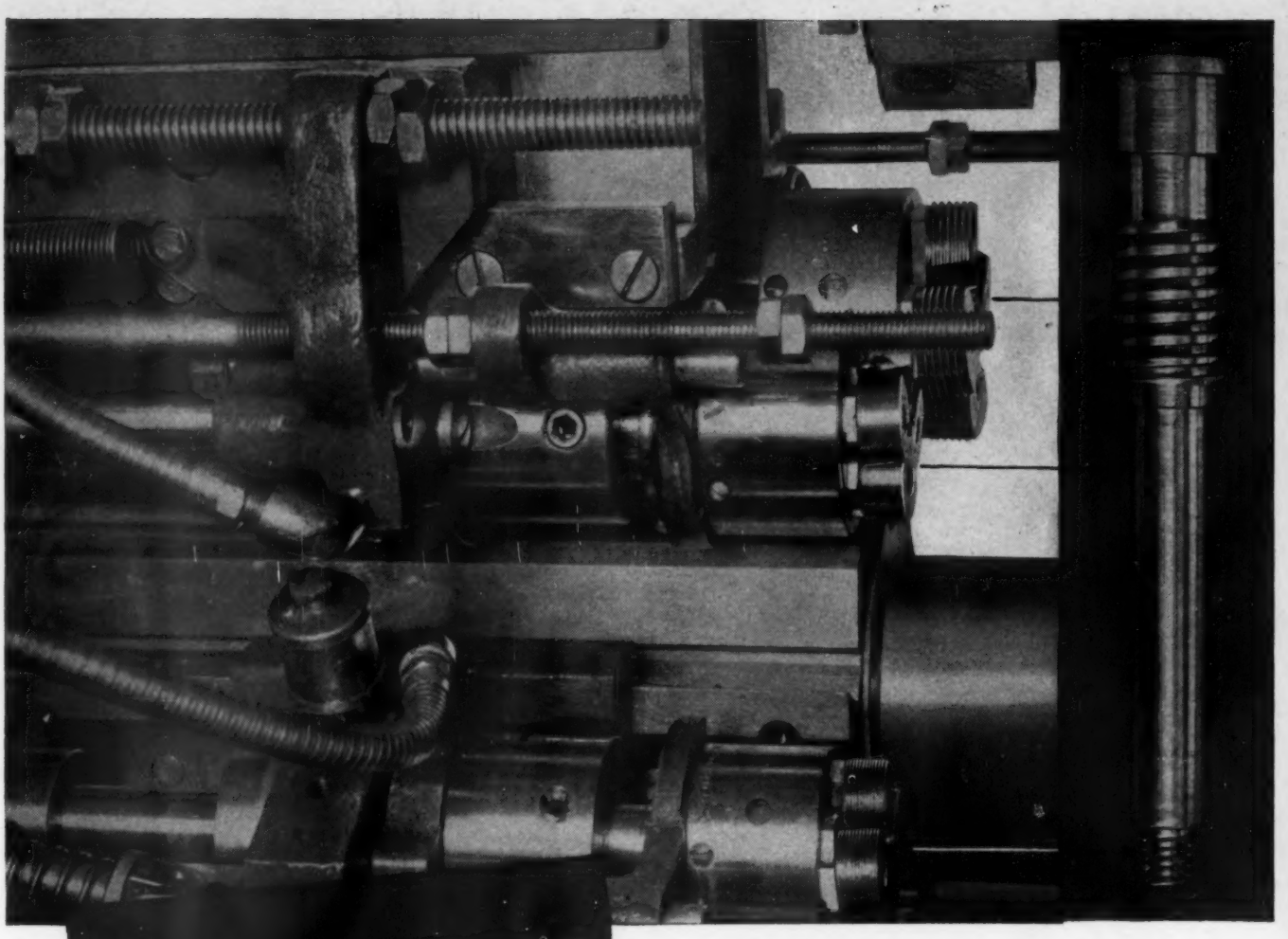
IDEAL INDUSTRIES, Inc.

(Successor to Ideal Commutator Dresser Co.)

1057 PARK AVENUE SYCAMORE, ILLINOIS

2010





VERS-O-TOOLS

Here is a sample of Accurate, Fast Production

This valve stem, made from type 303 stainless steel bar stock, is 6½" long by ⅞" diameter, requires 11 separate precision operations.

With Vers-O-Tools, an Acme-Gridley Bar Automatic does all these 11 operations in 49 seconds machine time—73 finished pieces per hour.

Vers-O-Tools are standard self-opening heads for high speed precision operations on automatics. They use circular chasers (ground thread) and circular cutters, for threading, end turning and forming, knurling, burnishing and other operations.

Precision regrinding of chasers and cutters is controlled by a micrometer grinding gage, and reground chasers are inserted in the head in one minute. After replacing chasers, the *first piece is production*—no cutting and trying needed.

Catalog D-42-C gives full details on this modern cost-reducing equipment for all types of automatic machines.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

Investment: A Warner & Swasey *Dividend:*

Securely Chucked—with the Turn of a Knob!
Work can be chucked in a matter of seconds with a Warner & Swasey Power Chuck Wrench. Heavier cuts can be taken on pieces that are held rigidly by power chucking. Grip pressures are controllable and uniform, making power chucking safe for thin-walled pieces, too.

Power Chuck Wrench 45% Production Increase!

THE CROWN CORK & SEAL COMPANY, Baltimore, Maryland, makes bottling machines. Each machine calls for 2 stainless steel center shafts $2\frac{15}{16}$" in diameter and 68½" long, with a 2-pitch Acme thread 10½" long on one end.

Formerly, the thread was cut by single point chasing; chucking the piece by hand was difficult for the operator and the machining operation itself took much time.

Then a Warner & Swasey Power Chuck Wrench was installed on the turret lathe, making it easy for the operator to chuck the job rigidly in a matter of seconds. The shaft is now held firmly enough to allow the thread to be cut with a die head at one pass. Results—a time saving on each piece of 25 minutes . . . and a happier operator!

This case history is only one of many showing how Warner & Swasey Power Chuck Wrenches have increased production by saving time on chucking and machining operations, and through greater operator efficiency.

Perhaps these same results can be accomplished in your shop. Your Warner & Swasey representative will be pleased to discuss the matter with you.

You can Machine it Better, Faster, for less . . . with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

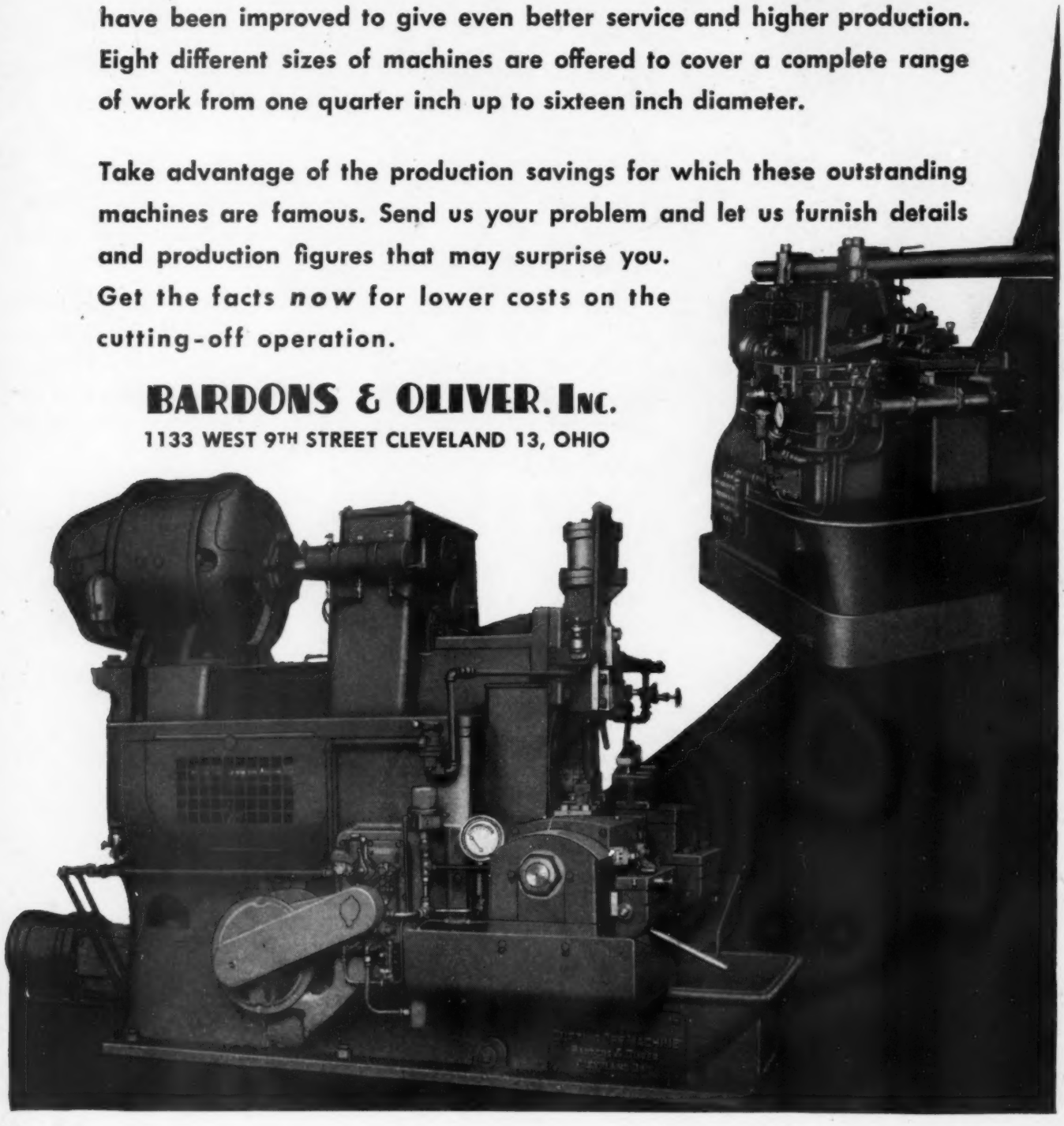
A Complete Line of Improved Cutting-Off Machines

FOR TUBING FROM 1/4 INCH TO 16 INCH DIAMETER

NOW LOWER your costs on the cutting-off operation with high production machinery. Bardons & Oliver cutting-off machines have been improved to give even better service and higher production. Eight different sizes of machines are offered to cover a complete range of work from one quarter inch up to sixteen inch diameter.

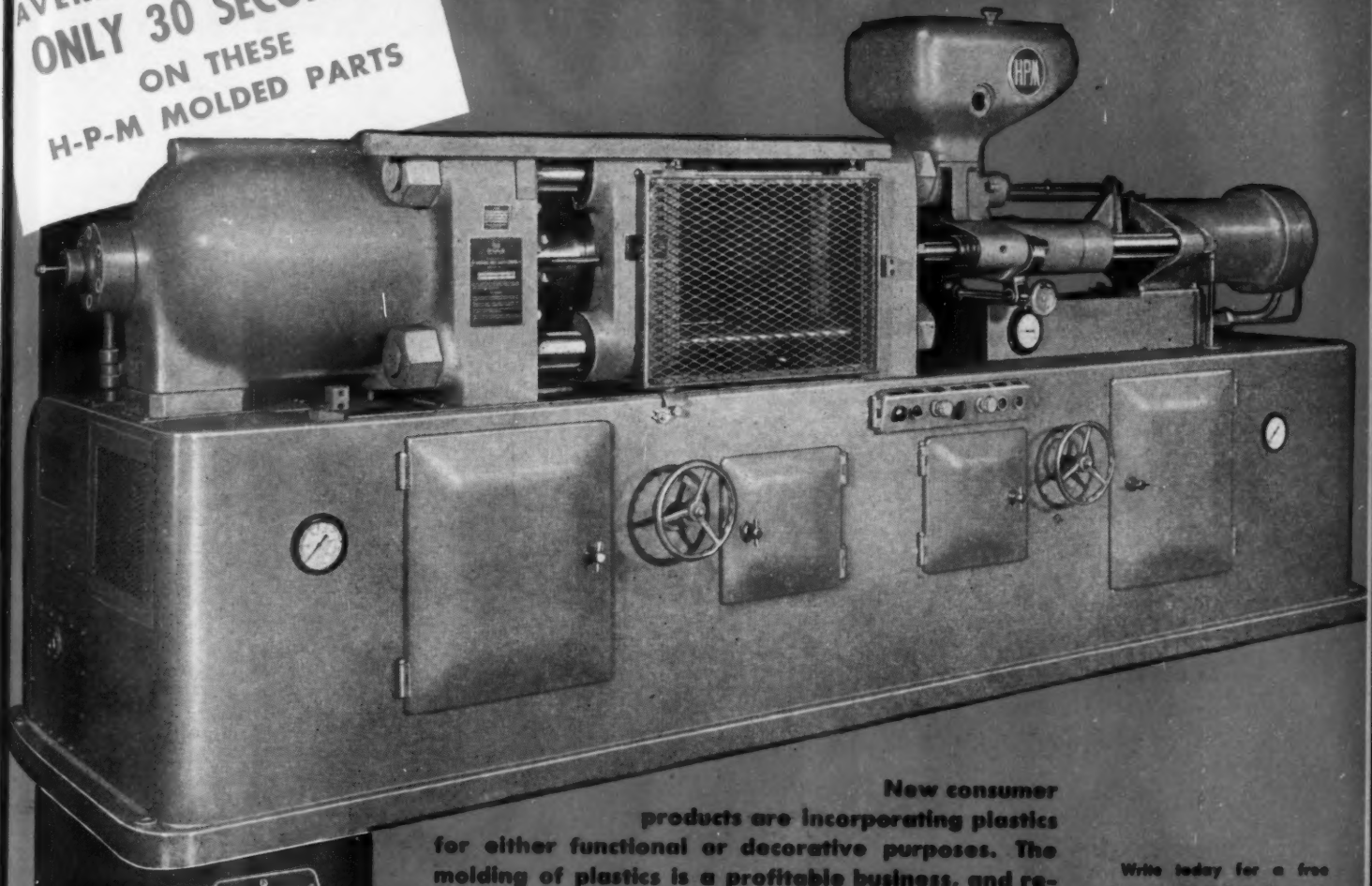
Take advantage of the production savings for which these outstanding machines are famous. Send us your problem and let us furnish details and production figures that may surprise you. Get the facts *now* for lower costs on the cutting-off operation.

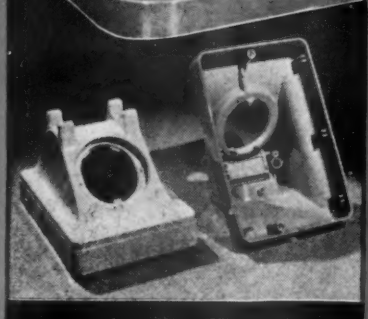
BARDONS & OLIVER, INC.
1133 WEST 9TH STREET CLEVELAND 13, OHIO

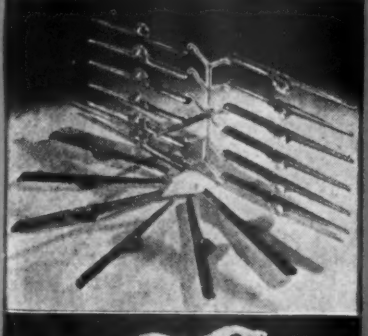


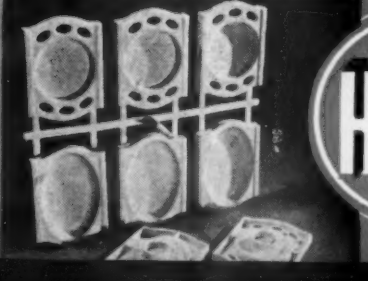
AVERAGE CYCLE TIME
ONLY 30 SECONDS
ON THESE
H-P-M MOLDED PARTS

THE H-P-M "9" OZ. IS THE IDEA SIZE FOR MOST MOLDING JOBS









New consumer products are incorporating plastics for either functional or decorative purposes. The molding of plastics is a profitable business, and requires very little capital equipment. With an H-P-M injection machine, and suitable molds, you are in a position to make your own plastic parts on a mass production basis. No other equipment is required, not even skilled operators.

The H-P-M 9 ounce capacity injection molding machine has proven to be the ideal size for most molding applications. Machine cycle is entirely automatic with "all-hydraulic" control. Send us sketches or samples of the parts you intend to manufacture. Our engineers will be glad to advise you how you can mold these parts profitably with H-P-M injection machines.

THE HYDRAULIC PRESS MFG. COMPANY
Mount Gilead, Ohio, U. S. A.

Branch Offices in New York, Philadelphia, Cincinnati, Cleveland, Detroit, and Chicago
Representatives in other principal cities.

Write today for a free copy of H-P-M Bulletin 4503 describing the versatile features of the H-P-M 9 ounce injection molding machine. Other sizes also available.

Self-Contained • All-Hydraulic

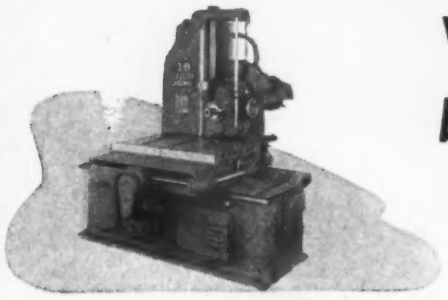
HPM **INJECTION MACHINES**
FOR MOLDING THERMO-PLASTICS

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

Retract and Reposition Your Work

within .0002" Selected Location

by Push Button Controls!



3-B DEVLIEG JIGMIL Provides for

Minimum Tool Overhang

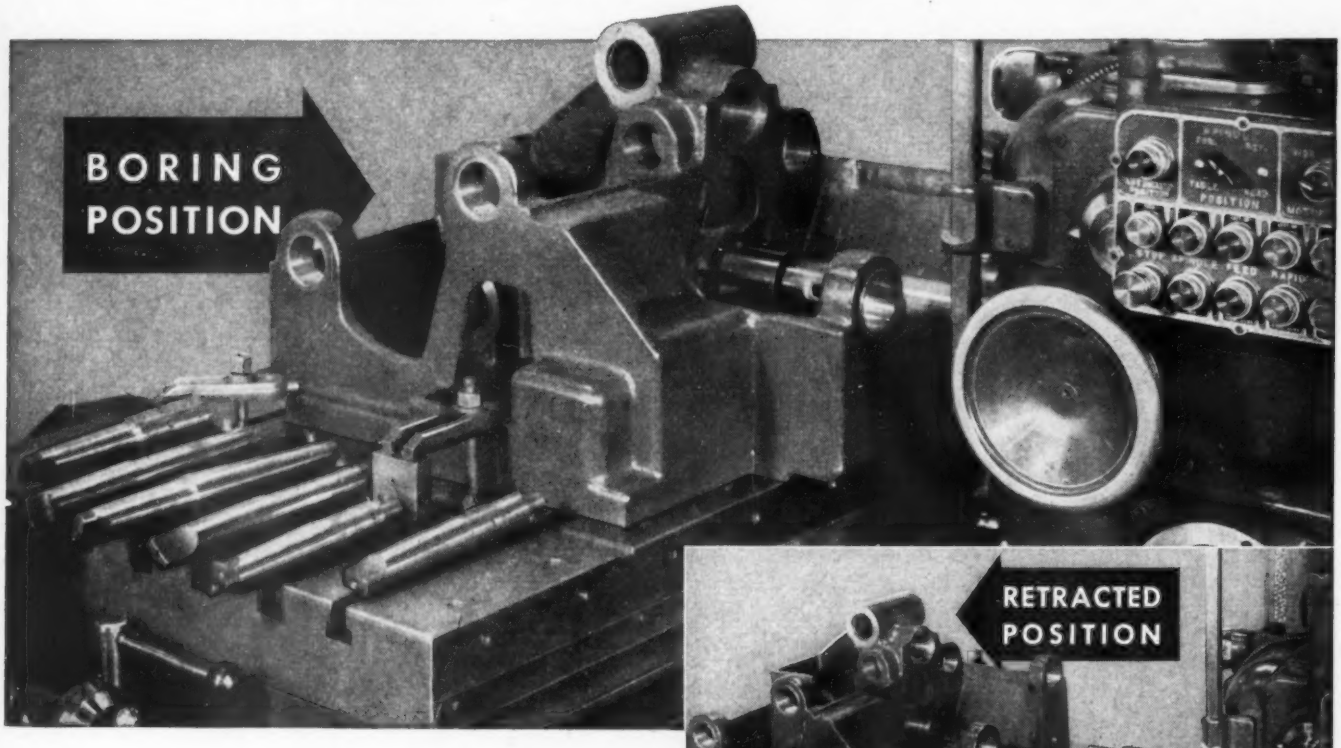
Maximum Operating Efficiency

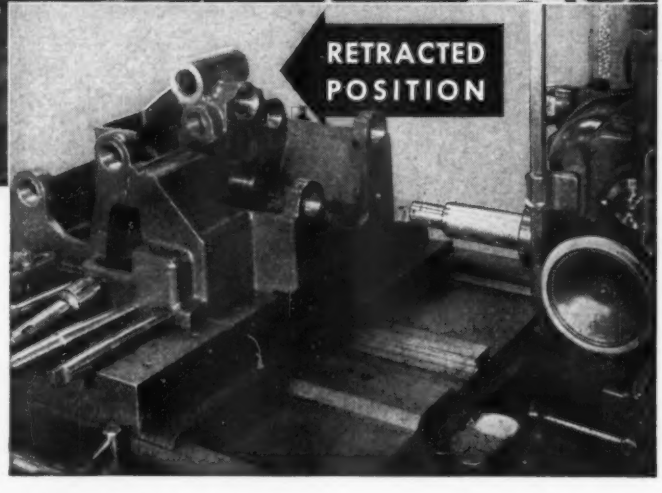
Greater *Controlled* Accuracy

You can save time, cut costs and reach new high standards of accuracy on your difficult precision jig boring and milling operations with a 3-B DeVlieg JIGMIL.

Location of work for minimum tool overhang and top performance advantage! Ready accessibility for necessary tool adjustments and changes! Convenience for checking machined dimensions! All these are served by JIGMIL's centralized push button control means which unlocks and retracts the table to open position, then automatically repositions and locks the table to within .0002" of the selected position.

In addition, JIGMIL's push button controls provide automatic hole spacing accuracy within .0001". Write today for complete descriptive and technical literature.





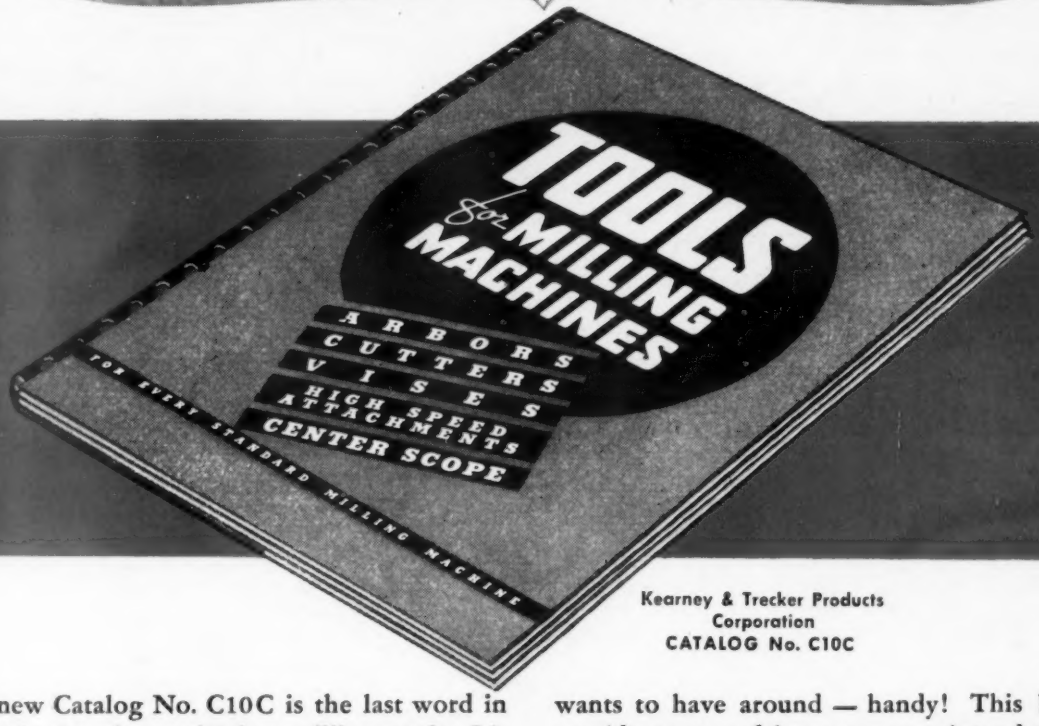
Here's Precision Boring at its Best!

The work piece above is an intricate casting for a three way diamond boring machine. All holes were bored on a 3-B DeVlieg JIGMIL to size, length and spacing accuracies of within .0001". Of the five castings comprising this particular job, the same high JIGMIL standard of accuracy was maintained throughout for perfect interchangeability of parts!

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

It's New! It's Complete! It's 5 Catalogs in One!

Neatly Bound In 1 Quick, Easy Reference Book



Kearney & Trecker Products Corporation
CATALOG No. C10C

This new Catalog No. C10C is the last word in convenience when selecting milling tools. It's actually 5 catalogs in one, giving complete technical data on Arbors, Cutters, Vises, and other accessories and equipment. 50 pages of useful information — spirally bound in one book that opens flat and smooth for quick, easy reading — it's the type of catalog every machine shop man wants to have around — handy! This bulletin would prove useful to your superintendent, master mechanic, tool and die men as well as your purchasing executives—send us your list on your company letterhead and we will be glad to mail copies to everyone interested in your organization. Would you tell us, please, the name of the magazine in which you saw this announcement.

Kearney & Trecker
Products
CORPORATION
Milwaukee 14, Wisconsin
Subsidiary of Kearney & Trecker Corporation

4716

Are You Missing a Bet?

Here's what 32 ALUNDUM

"50% faster cutting, 100% longer wheel life" — **Surfacing broaches**

"Ground 3600 pieces per wheel compared with 1200 to 1500 previously" — **Surfacing cast iron with segments**

"Gave over 40 holes per wheel compared to 10 for best previous wheel" — **Internal grinding of pump part**

"Ground 30 high speed steel crank lathe tools compared to 23 tools for competitive wheel" — **Sharpening tools**

"Gave over 1000 pieces per dressing compared to 300 previously" — **Surfacing razor parts**

"Wheel life of five weeks as compared with four weeks previously; 50 pieces per dressing compared with 20" — **Cylindrical grinding of shafts**

"Required 1/3 less dressing. Lasted 1/3 longer. Better finish, cooler cutting" — **Surfacing chrome steel**

is doing. . . . .

"Removes .002 – .003" per pass on large Hi-carbon and Hi-chrome dies as compared to .0005" with previous wheel" — **Surfacing dies**

"75% increase in life. Required no dressing" — **Sharpening file chisels**

"Wheel life 15% longer than competitive wheel. Required dressing only once every two days, no loading" — **Snagging forgings**

"Lasted 16 days against three days for competitive wheels and cut better" — **Surfacing dies with segments**

When ordinary abrasives are crushed to size it results in many grains with flat sides. When such grains are bonded into a wheel it is often a flat side that is exposed in the surface instead of a useful cutting point.

No crushing to size is necessary with 32 ALUNDUM abrasive. The grains form as individual crystals — pointed on all sides. No matter how they are bonded into a wheel one or more cutting points are exposed.

and HERE'S WHY!

The crushing process used to reduce ordinary abrasives to commercial sizes produces many grains with flat surfaces and long edges. When these grains are bonded in a wheel they often locate with a flat area exposed in the surface instead of a useful cutting point.

Because the grains of 32 ALUNDUM abrasive form in the electric furnace as complete crystals each one has sharp points on all sides. No matter how these uncrushed grains are bonded into a wheel one or more cutting points will be exposed.

This means that in a wheel of 32 ALUNDUM abrasive there are many more cutting points doing the work. And these cutting points are extremely resistant to dulling because "32" is over 99% pure fused alumina.

The greater number of longer-lasting cutting points doing the work means that a 32 ALUNDUM grinding wheel removes stock more rapidly. Because grinding heat is spread over more points, and points that stay sharp longer, "32" wheels cut cooler. Because there are more points doing the work and points that don't dull quickly, 32 ALUNDUM wheels require fewer dressings and last longer.

NORTON COMPANY, WORCESTER 6, MASS.

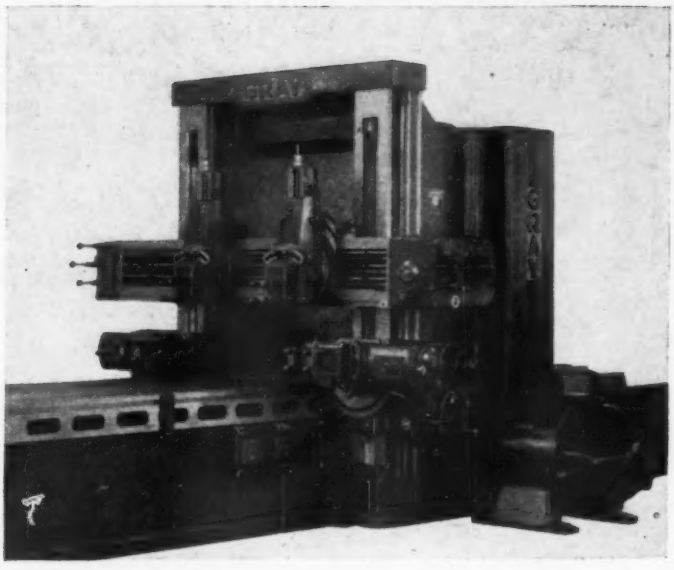
Distributors in All Principal Cities

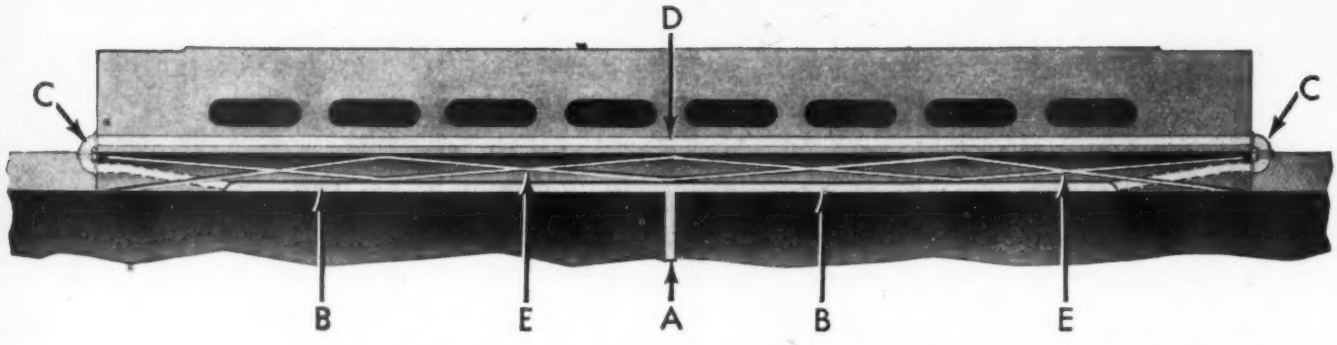
NORTON ABRASIVES

LOOP LUBRICATION

pioneered and perfected by

THE G. A. GRAY COMPANY





Former types of forced lubrication were satisfactory for table speeds around 100′ per minute, but not for modern speeds of from 200 to 300′. This is due to the fact that it is impossible to force oil through oil channels at such high speeds with feasible oil pressures. If the oil pressure is raised too high, it will lift the table, but if the oil does not flow as rapidly as the table moves, a vacuum will tend to be created in the oil channel at the end of the table, so that the lubrication not only fails, but dust laden air and dirty oil is sucked into the oil channel. Loop Lubrication with its endless belt of clean oil, kept at constant pressure, completely solves the problem.

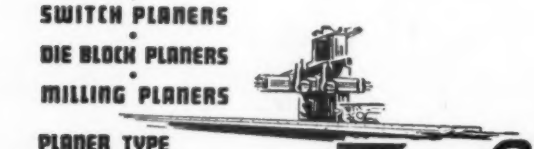
With Loop Lubrication, oil under 4½ pounds pressure enters the system at "A", flows through channel "B", through cross header "C", into connected pipe "D" forming a continuous loop. This loop being continuous, maintains constant oil pressure throughout the table length, irrespective of the table's position on the bed, and also irrespective of the speed of the table or the resistance of the ways to the flow of oil. From triangular channel "B", diagonal grooves "E" distribute oil over all parts of the ways. Note entire absence of oil pockets or grooves in the vees of the bed.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS
•
PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES

Remember **"A PLANER IS NO BETTER THAN ITS WAYS"**

There is no adequate substitute for Gray NON-METALLIC WAYS* and LOOP LUBRICATION.*

*Patented



The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

Sold in Canada by Upton, Bradeen and James Ltd. ● **Sold in Latin America by Machine Affiliates.**

FOR TODAY'S TOUGHER JOBS, HERE'S A NEW TOUGHER MOTOR

WHERE IT'S WET Wet weather doesn't bother the new totally-enclosed Tri-Clad motor. Neither do frequent "washdowns" in food plants.

WHERE IT'S CORROSIVE Acids, alkalis, and fumes are kept out of these new Tri-Clads. Cast-iron enclosures are corrosion-resistant, extra strong.

WHERE IT'S DIRTY Dirt and dust can't get into these Tri-Clads to shorten their life. Smooth surfaces are convenient to clean.

WHERE IRON DUST FLIES Harmful iron dust and metal filings can't get past the inner wall. Bearings are protected from dust.

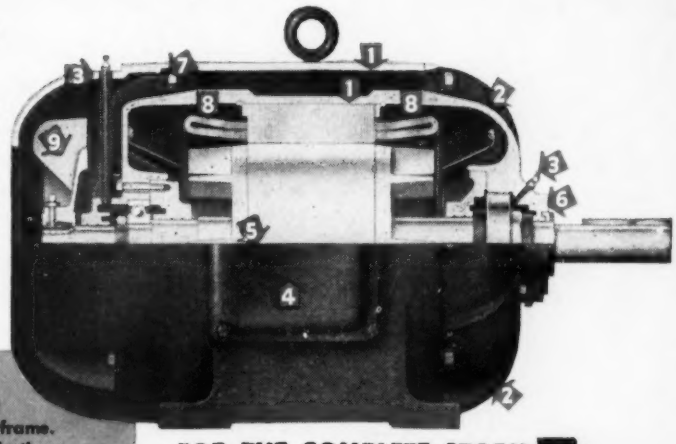
WHERE QUARTERS ARE CLOSE When space is limited for a totally enclosed motor, you'll like these trim, compact new Tri-Clads.

WHERE EXPLOSION HAZARDS EXIST The new Tri-Clad motors are available in explosion-proof constructions where needed.

THE G-E TRI-CLAD TOTALLY ENCLOSED MOTOR

(1 TO 1000 HP)

In 1940 you welcomed the Tri-Clad open motor with it's *extra protection features*. More Tri-Clads have since gone into service than any other integral-horsepower motor. Now G.E. is ready with a new line of tough, totally enclosed Tri-Clad motors for use in adverse atmospheres. *We believe they are industry's most dependable motors.* Their longer life and lower maintenance will make them a sound investment on almost every job. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.



10-POINT PROTECTION

1. A cast-iron, double-wall frame completely encloses and protects the windings and punchings.
2. Corrosion-resistant cast-iron end shields are machined to provide a tight seal, and protect the motor from dust, dirt, and moisture. Primer and finish coat of Glyptal* varnish affords high rust-resistance.
3. A pressure-relief greasing system, which can be packed with long-life lubricant, protects the bearings.
4. The cast-iron conduit box is diagonally split for easy wiring. Boxes are independently explosion-proof on Class I motors.
5. Nonshrinking compound around motor leads protects motor interiors from dust and moisture at the point where leads pass through the frame.
6. Rotating labyrinth seal further protects motor interior from damage by foreign matter.
7. Large air passages provide adequate protection from overheating. They're easy to keep clean and open, too.
8. Modern, "ageless" insulation treatment includes windings of *Formex magnet wire.
9. The powerful external fan is removable to simplify maintenance; nonsparking type in explosion-proof motors.
10. Individual dynamic balance of rotors and external fans protects against vibration hazards, even under severe operating conditions.

*Trade-mark Reg. U. S. Pat. Off.

FOR THE COMPLETE STORY

Apparatus Department, Section EE750-278C
General Electric Company
Schenectady 5, N. Y.

☐ Please send me GEA-4400, which describes the new Tri-Clad totally enclosed motors.

☐ Please send me GEA-4131, "Motors and Control for Hazardous Locations."

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We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

Picture of Perfection

. . . by UNION

They're able and accurate! . . . They're designed for precision and proved under production pressure! . . . They're pictures of perfection! . . . They're UNION — The Tools You Buy Again!

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"THRED-RITE" DIES AND HOLDERS

Use this simple, accurate, efficient collet die on jobs where accuracy must be obtained with minimum attention. It is especially designed for high speed operation, for producing threads to a high standard of precision. The graduated micrometer lock nut makes it possible to split .001". Full floating construction assures accurately centered work.

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When your threading jobs call for unvarying quality, choose the taps that have been synonymous with quality for over 70 years. The Card line is complete, so that you can take advantage of Card Quality on every tapping job.

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NEW MAN-AU-TROL SPACER

Designed for installation *by you* on your drills, the new Bullard MAN-AU-TROL Spacer, in most cases, eliminates hole-locating jigs... and the time, money and labor required to design, make, handle, repair and store them.

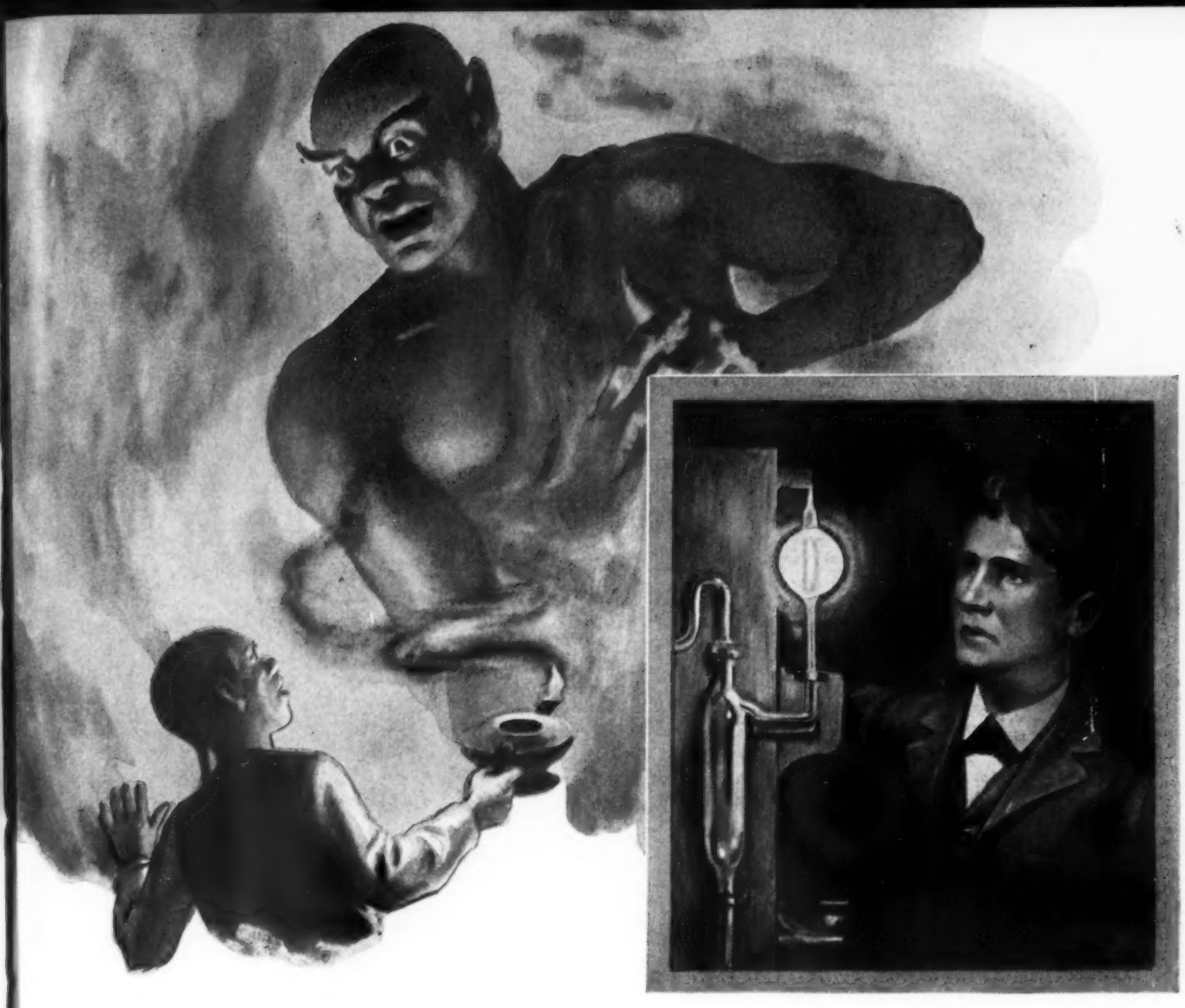
With unprecedented speed, ease and accuracy, you can set up the Spacer to do the work of jigs that may take weeks or months to make. Once its lateral and longitudinal position stop rods are set for a pattern of holes, the manually controlled, automatically operated Spacer will repeat that pattern indefinitely *to the highest standard of commercial spacing accuracy.* Extreme flexibility permits the use of the Spacer on a large variety of large and small work.

The results: faster, more accurate production... lower costs... less overhead... less human fatigue—all valuable factors in improving your competitive position. Write for MAN-AU-TROL Spacer Bulletin.

BULLARD

CREATES NEW METHODS TO MAKE MACHINES DO MORE

Made in 2 sizes—30" x 20" (illustrated) for larger work on 4', 5' and 6' Radial Drills; and 4" x 4" for work usually done on smaller types of drills.



IT WAS EDISON, NOT ALADDIN WHO REALLY HAD THE LAMP!

"ALADDIN'S LAMP" made good reading but gave little illumination to a light-hungry world. It was the tiny glow of Edison's incandescent lamp that expanded into the radiance which floods the globe.

Hard on the heels of Edison's invention came the need for transmitting electricity, economically, over long distances. Thus, the development of alternating current in the 1880's enabled this young nation to set the pace in the whole realm of electricity. For here was an economical means of transmitting electrical energy at high voltages and with low losses—not only for light, but also for the heat and power on which the growth of industry thrived.

Then, as now, electricity and copper were inseparable... and The American Brass Company was already a leading supplier of copper, brass and bronze. Today, with more than a hundred years of manufacturing experience behind it, this Company continues its help in working out many of the metal problems peculiar to the electrical equipment and appliance industries ... and to the fields of electric power generation, distribution and control.

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THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut

ANACONDA from mine to consumer

Anaconda Copper & Copper Alloys

In the Electrical Industry

Nothing serves like Copper and its Alloys

Extruded shapes of unusual or intricate cross sections. Screw machine products; electric clock gear trains, instrument parts, etc.
Vacuum tube base pins; stamped and drawn eyelets; radio and thermostat parts, electrical sockets, lamp and fuse bases, etc.
For applications requiring special properties: Hardware, bolts, machine screws, tie rods, heat exchangers, pressure die castings.
An engineering alloy of extremely uniform grain structure. Used for bolts, nuts, screws, bushings, etc. Also welding rods.
LEADED BRASSES
YELLOW BRASSES
COPPER, PLUS 30% TO 40% ZINC
SPECIAL BRASSES
COPPER, PLUS ZINC, PLUS OTHER ALLOYING ELEMENTS
TOBIN BRONZE*
COPPER, PLUS 39% ZINC, PLUS 0.75% TIN
Free cutting silvery white alloys used for screw machine products such as terminals, decorative parts, gage and meter components.
Stamped, drawn and spun parts such as cups and shells. Also water pipe and heat exchanger equipment.
LEADED NICKEL SILVERS
RED BRASSES
Silvery white alloys for stamped, drawn and spun electrical appliance parts; also electrical resistances.
Etched plates; screws, hardware; stampings and hot pressed forgings; electric motor components.
NICKEL SILVERS
COMMERCIAL BRONZES
Screw machine products: Hardware, gears, pinions, bearings, bushings and other parts requiring high resistance to wear.
Exceptionally corrosion resistant engineering alloys. Used for steam condenser tubes and tube sheets; turbine blading.
CUPRO-NICKELS
LEADED BRONZES
High strength springs, clips, snap switches, electrical contacts, fuse clips, bushings, bearings, welding rods.
Special high strength engineering alloys. Resist oxidation at elevated temperatures.
ALUMINUM BRONZES
COPPER, PLUS 5% TO 8.5% ALUMINUM
BRONZES
A heat-treatable copper alloy combining good electrical conductivity with unusual spring properties.
Strong, weldable, copper-silicon alloys of wide application. Corrosion resistant poleline hardware, etc.
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COPPER, PLUS 2.15% BERYLLIUM, PLUS 0.25% NICKEL
EVERDUR* COPPER, PLUS 1.5% TO
*Reg. U. S. Pat. Off.
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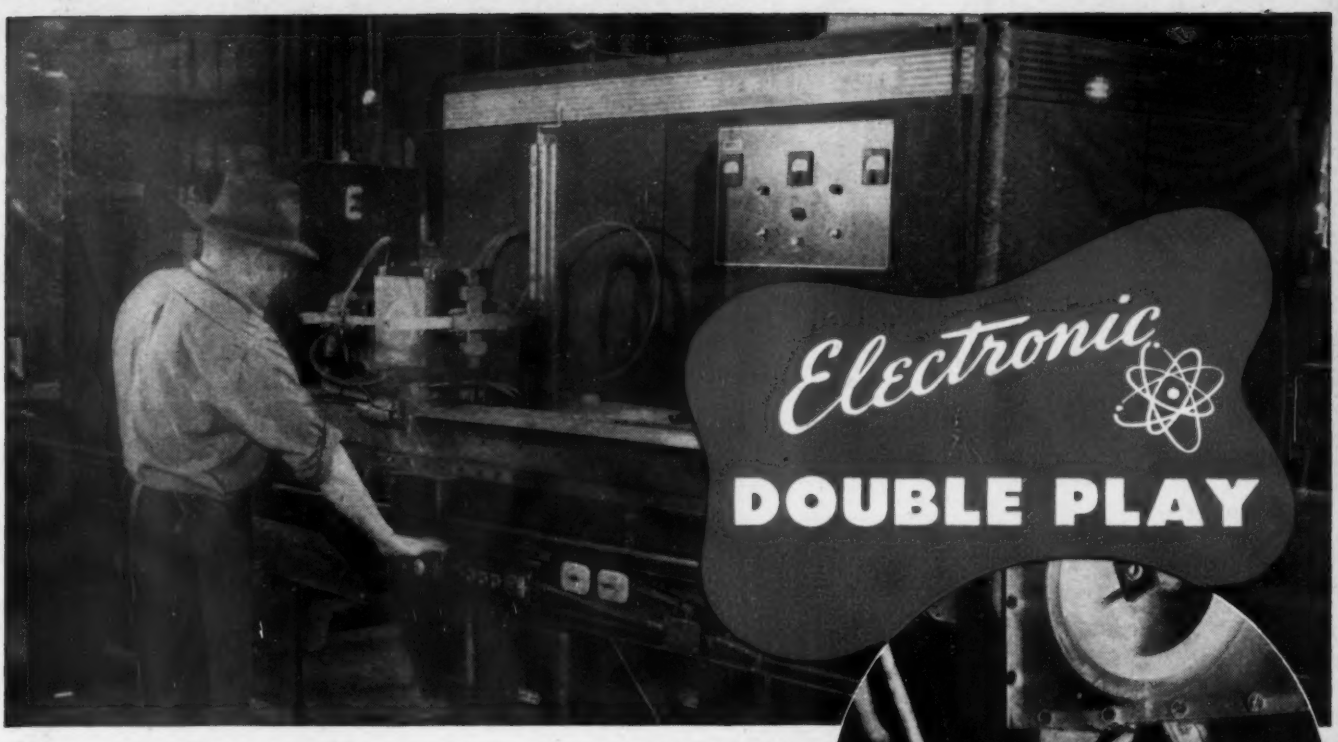
COPPER
Coaxial cable components, switch blades, welding rods, capillary tubes, "Electro-Sheet" shielding, seamless tubes and fittings.

ANACONDA
from mine to consumer

Made by THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut • Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

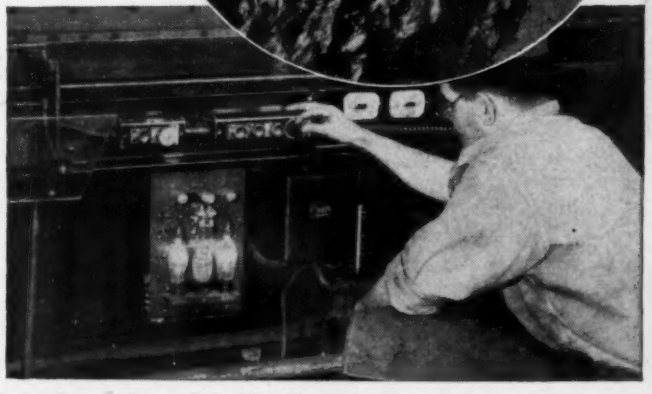


G-E ELECTRONIC HEATER and THY-MO-TROL DRIVE SOLVE DIFFICULT DIE-HARDENING PROBLEM

How could the wearing surfaces of brake dies measuring up to 20 feet in length be efficiently hardened? Because of the distortion difficulties due to the length of the dies, furnace hardening and salt-bath hardening were out of the question.—This was the problem referred to G-E engineers by the Dreis & Krump Manufacturing Company in Chicago.

After carefully analyzing the production requirements of this company, G-E heating specialists scored an electronic double play. The dies to be hardened are passed under the work coil of a G-E electronic heater by a G-E Thy-mo-trol-controlled carriage. Since the Thy-mo-trol drive equipment is connected into the plate circuit of the electronic heater, the speed of the carriage varies directly with the power output of the electronic heater. Thus, with this controlled carriage-speed and power-output ratio, the brake dies are hardened uniformly, with close depth control, and with minimum distortion. Also, Dreis & Krump are now producing a better product at a cost considerably lower than that of any other previous method of die hardening.

Perhaps your heat-treating operations could be similarly improved in speed, quality, and economy with G-E equipment and expert heat engineering. We shall be glad to furnish you with detailed information on G-E electronic heaters and to make specific recommendations for their application to your individual requirements. Just fill out and mail the coupon.



Brake-die wearing surface (above), passing under G-E electronic heater's work coil and into quench shoe for hardening.

Detail of electronic Thy-mo-trol equipment (below), for regulating carriage speed with heater's power output.

GENERAL ELECTRIC

Apparatus Dept., Sec. M675-145
General Electric Company, Schenectady 5, N. Y.

My heat-treating problem is.....

.....

.....Please have a G-E heating specialist get in touch with me.
.....Please send me the following free bulletins:
GEA-4284A "G-E 5-Kw Electronic Heater"
GEA-4637 "G-E 20-Kw Electronic Heater"
GEA-4348 "G-E 50-Kw Electronic Heater"

Name.....
Company.....
Address.....
City.....State.....
8746

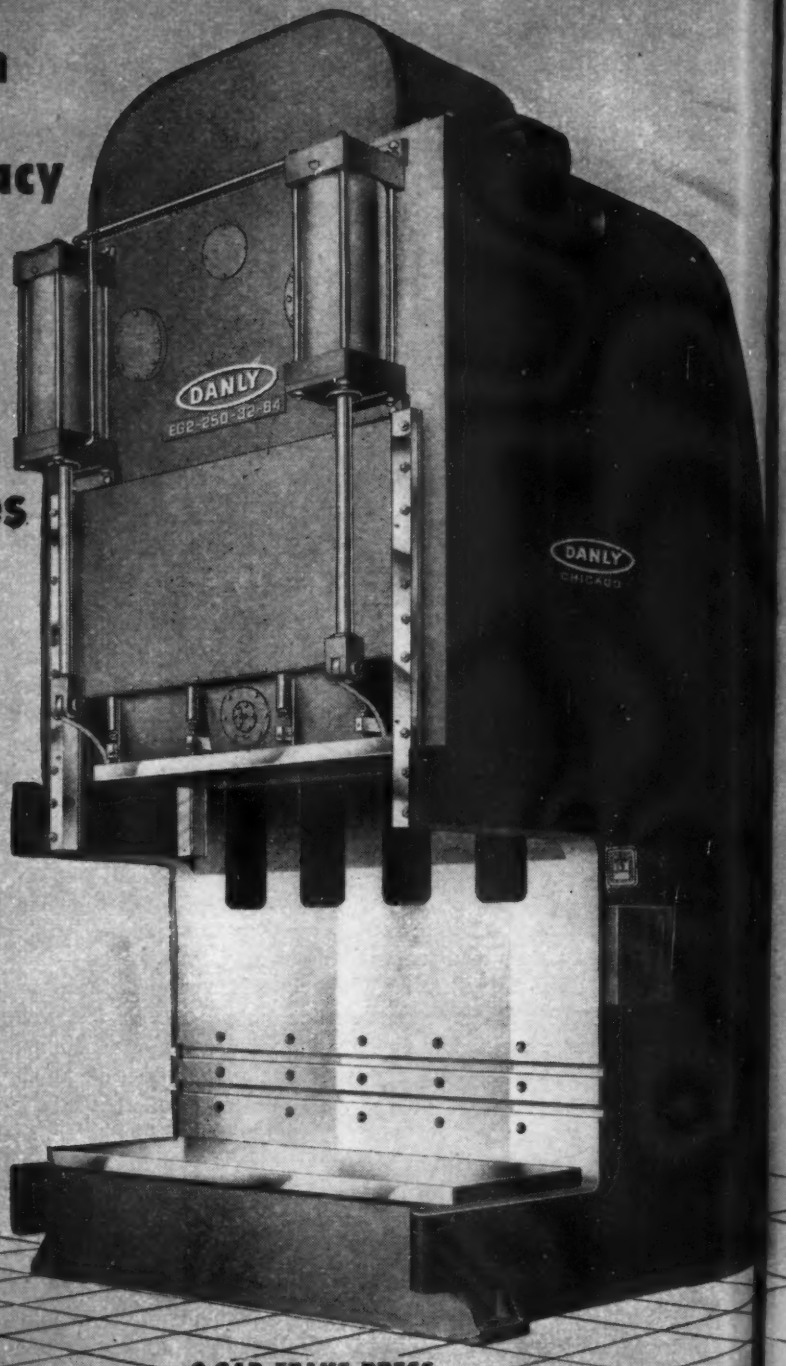
DANLY PRESSES

1. Rugged Construction
2. Mechanical Accuracy
3. Pressure Lubrication
4. Air-Friction Clutch
5. Modern Design Features

● INCLINABLE PRESS

The 100-ton, eccentric gear, Inclinable Press, *shown left*, has a unit frame—one piece cast steel or Danlyweld as specified, and an all-steel Danlyweld base. Extra long gibs and two suspension points—insure even pressure along the full length of the stroke, make for accurate alignment on large or progressive dies.

This press has an 8" stroke—operates 40 strokes per minute. Adjustment of slide—4" by hand. Bed area is 31" x 40"—designed to be equipped with air cushion if desired. Pivot point is so arranged that the center of the bed is not elevated when press is inclined. Distance floor to bed—33". Shut Height—19".



● GAP-FRAME PRESS

The 250-ton, 2-Point Eccentric Gear Gap-Frame Press, *shown above* is of all steel Danlyweld construction. Intermediate *continuous* structural members extend up through the back of the frame reducing deflection throughout the entire length of the bed. Gearing and driving members are completely enclosed within the frame.

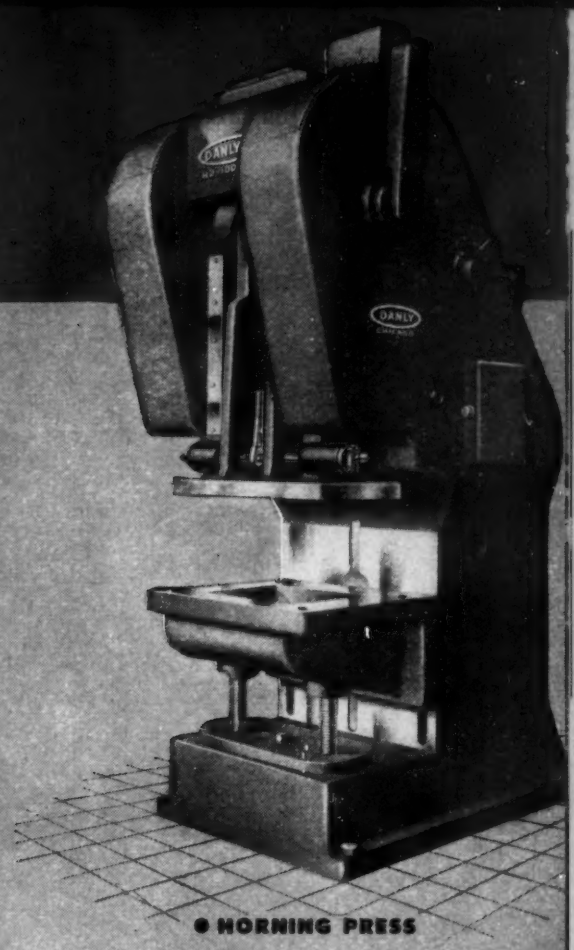
This press has a 14" stroke—operates at 20 strokes per minute. Bed area is 32" x 84". Shut height—54".

THE PRESS for MODERN PRODUCTION...

● 4-POINT STRAIGHT-SIDE PRESS

Compact, enclosed construction keynotes the design of the 300-ton Straight-Side Press, shown above. Gears and driving members are completely enclosed within the frame.

This press has eccentrics cut on the four main gears and 4 Suspension Points—Extra Long Gibs. Bed area is 58" x 96". Stroke is 18"—Double geared to operate at 18 strokes per minute. Adjustments of Slide—12". Shut height—54". Air-Friction Clutch, Electric Stroke Indicator, and Push-Button Control—Motor Adjustment of Slide, are standard equipment on this model.



● HORNING PRESS

The 100-ton Eccentric Gear, Horning Press, *shown above*, has a one-piece cast-steel frame. Extra-long gibs and 2 suspension points—unusual features in a press of this type and size, make for accurate alignment on large or progressive dies.

This press has an 8" stroke—operates at 40 strokes per minute. Adjustment of slide—4", by hand. Shut height with knee adjustment down, slide adjustment up—20"; adjustment of knee—10". Shut height with knee removed—39".

DANLY

MACHINE SPECIALTIES

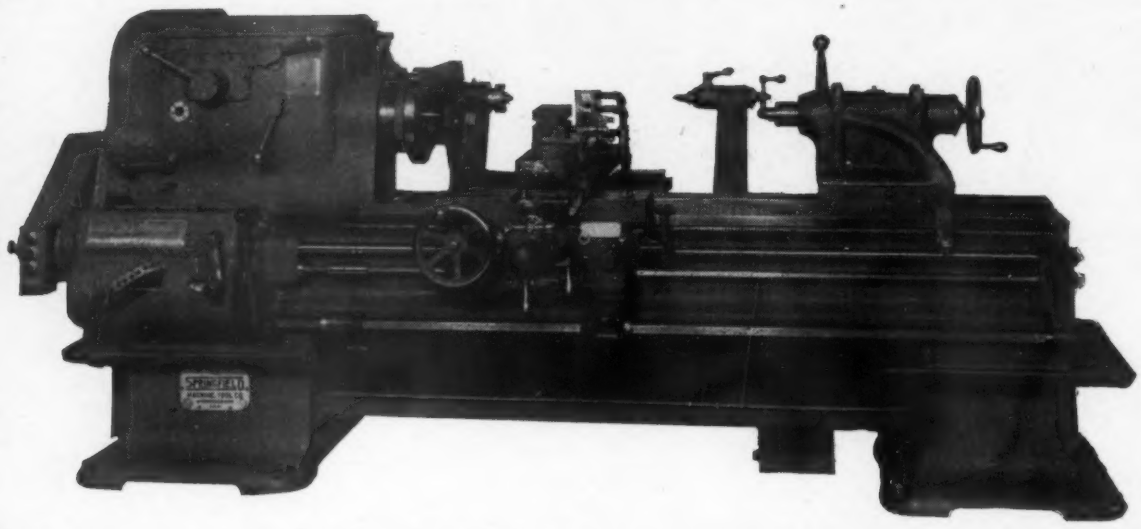
INC.

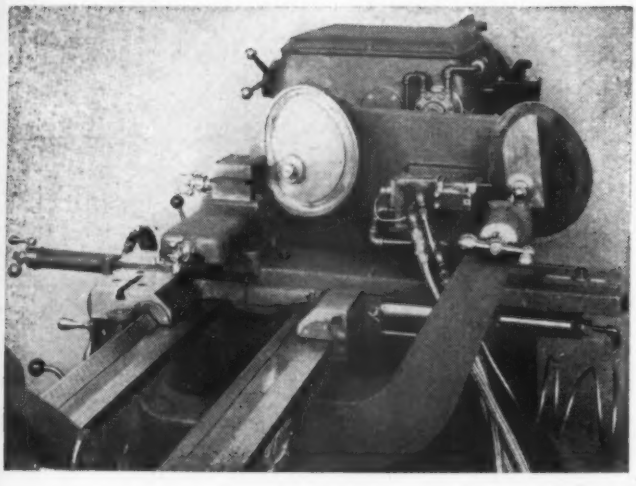
●

2100 SOUTH 52nd AVENUE

CHICAGO 50, ILLINOIS

Duplicating cams or molds?

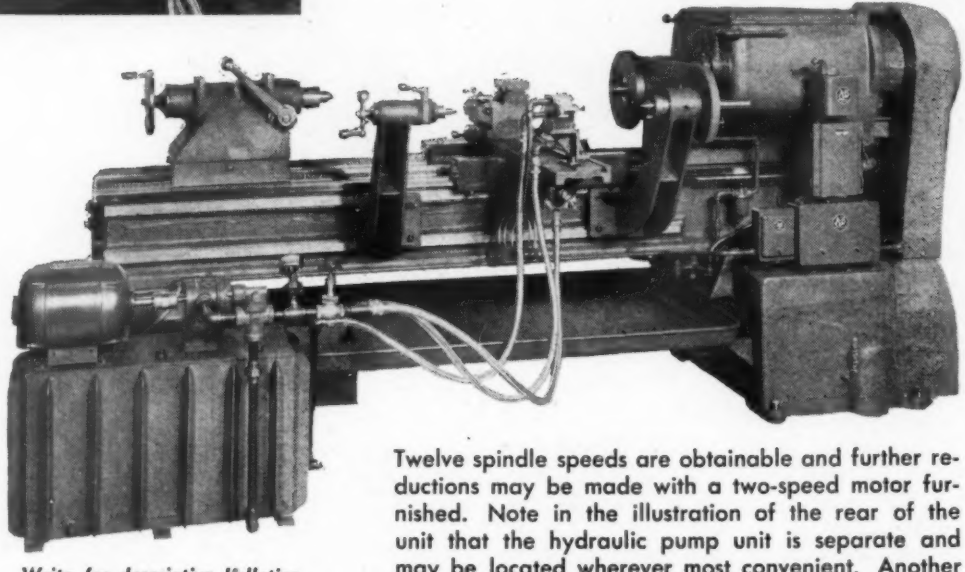




YOU CAN DO IT FASTER AND AT LOWER COST WITH A SPRINGFIELD DUPLICATING MACHINE!

The SPRINGFIELD Profiling and Duplicating Machine produces exact duplications of needed parts with only the original part or an inexpensive wood or thin metal templet to follow. Extreme accuracy can be expected regardless whether the job requires operations across or parallel to the centers.

Shown above is the actual production of a contour-cam on the Springfield Profiling and Duplicating Machine. Notice that only a thin metal pattern is being used and that the operator has a clear view of the work at all times. A master cylinder, located under the cross slide (and controlled by a stylus valve) guides the tool in the proper contours. Templets that require rotation are driven by the spindle through an adjustable chain drive.



Twelve spindle speeds are obtainable and further reductions may be made with a two-speed motor furnished. Note in the illustration of the rear of the unit that the hydraulic pump unit is separate and may be located wherever most convenient. Another valuable feature—the adjustment of only two screws converts the machine so that it may be used for normal engine lathe work.

Write for descriptive Bulletins. Investigate the time and money saving possibilities of the Springfield Profiling and Duplicating Machine.

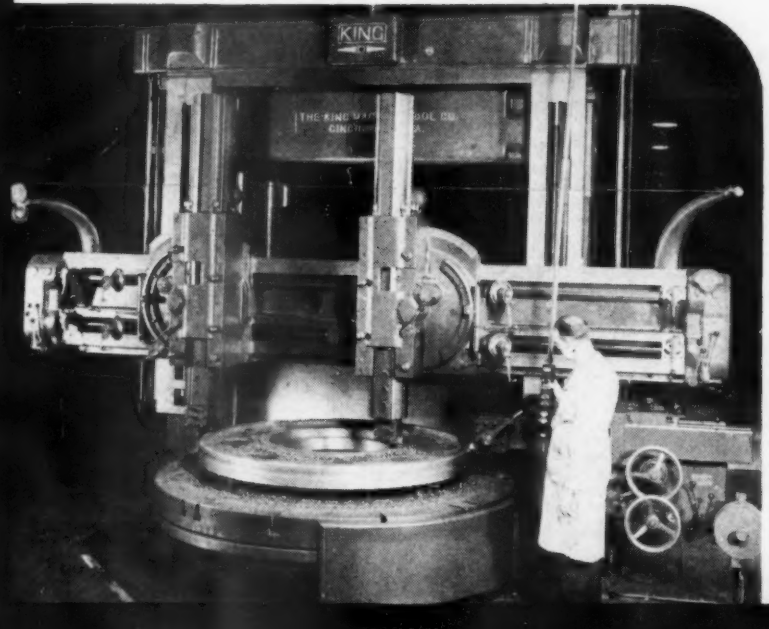
THE SPRINGFIELD MACHINE TOOL CO., *Springfield,* OHIO

3 Heads OPERATING AT ONCE

KING

New Series

VERTICAL BORING & TURNING MACHINES



● Boring - turning - facing simultaneously with 3 heads in operation at once is indicative of the rigidity and smooth power provided in the new series King Vertical Boring Machine.

The job shown is a 74" diameter feed worm wheel being machined for a prominent machine tool builder.

On work where carbide tools can be used most efficiently and economically this new series King offers several advantages. New rectangular type rams — saddle for ram head square locked and fitted with four tapered gibs for adjustment — a heavy tie plate across the swivel are points in construction that assure greater rigidity and accuracy.

For long service—low maintenance, investigate the new King.

Available in 10 sizes: Single column 30", 36", 42". Double column 52", 62", 72", 84", 100", 120", 144".

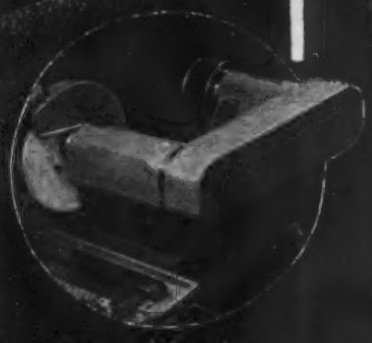
THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

Builders of Vertical Boring and Turning Machines Exclusively

Designed for EFFICIENCY

TO PRODUCE MORE OF A GREATER VARIETY THRU EASE OF PRECISION SET UP AND OPERATION



External Bracket

Internal, External Turret

The Rivett No. 104 is a simple, power-driven grinder suitable for tool making and precision manufacturing. Operations of widely varying nature can be quickly set-up and efficiently ground on one or many pieces. Interchangeable brackets are selectively mounted on the cross slide for internal, external, or concentric grinding in straight, taper, face or shoulder form.

RANGE

Internal spindles of suitable design and speed may be selected for hole grinding up to approximately 3" diameter and 4" length.

External bracket with 7" x 1/2" wheel may be used for on-center or chucked work up to approximately 3" diameter.

Turret for concentric grinding of hole or outside surface is limited to such work as may be chucked.

ARMY E NAVY

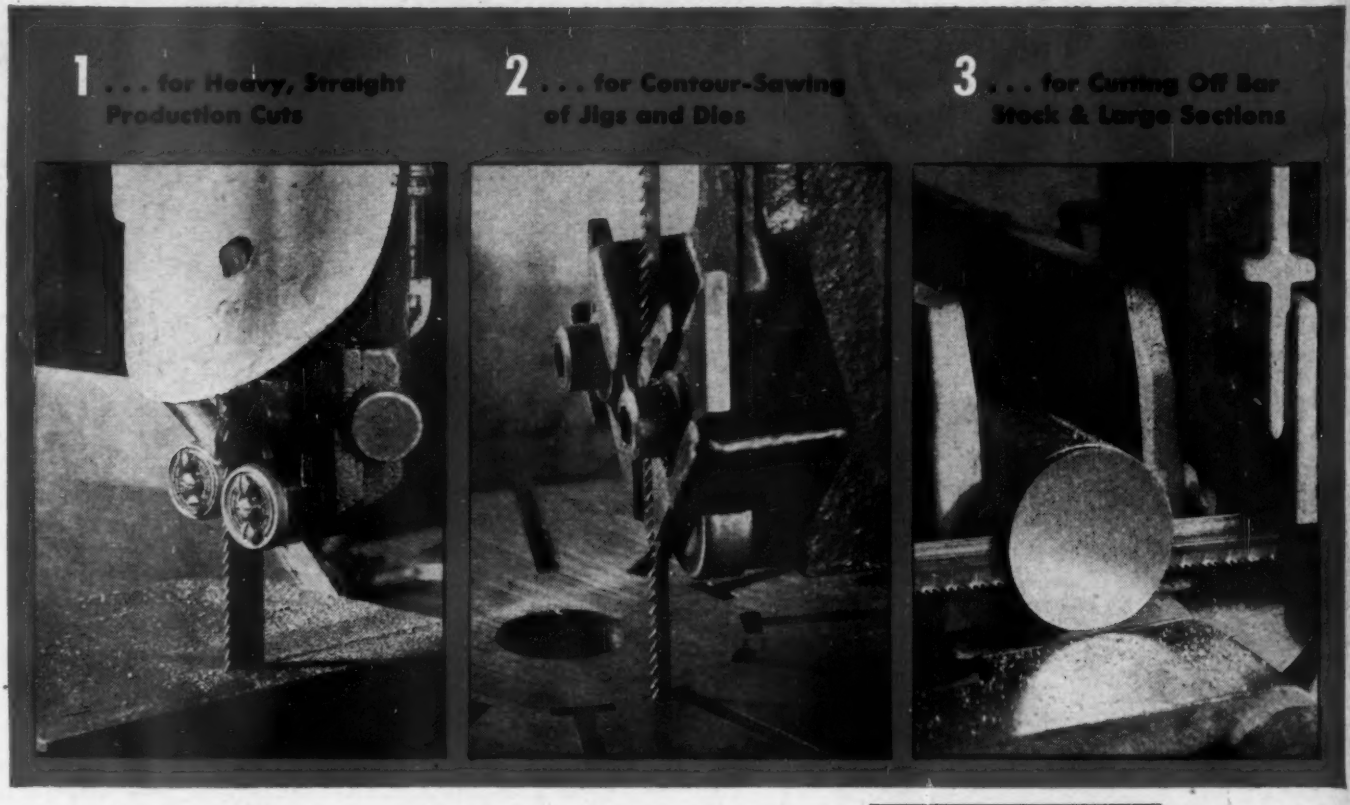
RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON · BOSTON · MASS. · U. S. A.

Write for Bulletin 104.

How
Small Shops and Big Plants
SAVE MACHINE-HOURS AND SPUR PRODUCTION
BY USING
SIMONDS METAL-CUTTING BAND SAWS



Set free your millers, shapers, lathes, broaches and drill presses *for their own work.* Use metal-band-sawing machines — and Simonds Hard Edge Band-saws — for the types of work shown above, and many other jobs.

Simonds Hard-Edge Metal-Cutting Bandsaws are made of special electric steel poured to Simonds' own specifications to stand the shocks and strains of this work *longer than any alloy steel.* Then, too, the rounded gullets and special tooth-set makes for smoother cutting and longer blade life on any of the jobs shown above — or any others. Ask your ISD for Simonds Hard-Edge Metal-Cutting Bandsaws . . . also for Spring-Temper and Skip-Tooth Bandsaws, if your needs warrant. Or call the nearest Simonds office listed at the right.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

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SIMONDS CANADA SAW CO. LTD. — MONTREAL TORONTO VANCOUVER SAINT JOHN, N.B. — *Simonds Products for Canada*

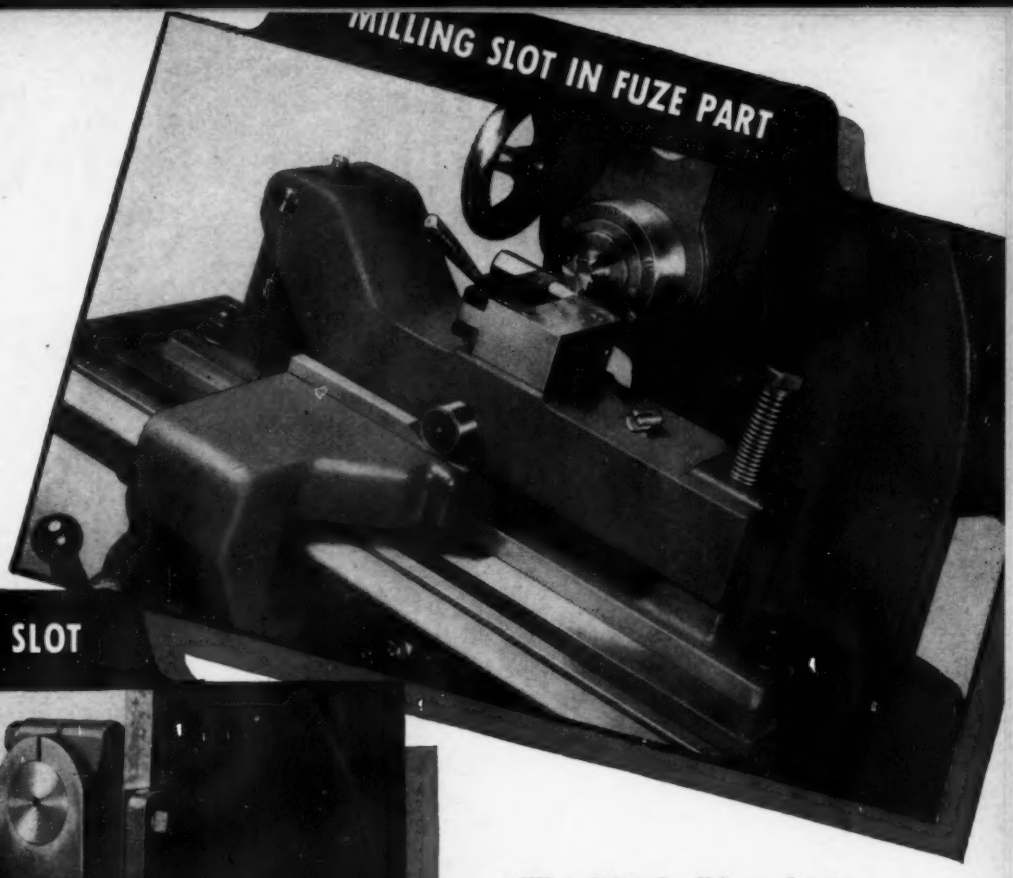
BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

3 SMALL MILLING JOBS WHERE THE No. 000 SHOWS REAL SAVINGS

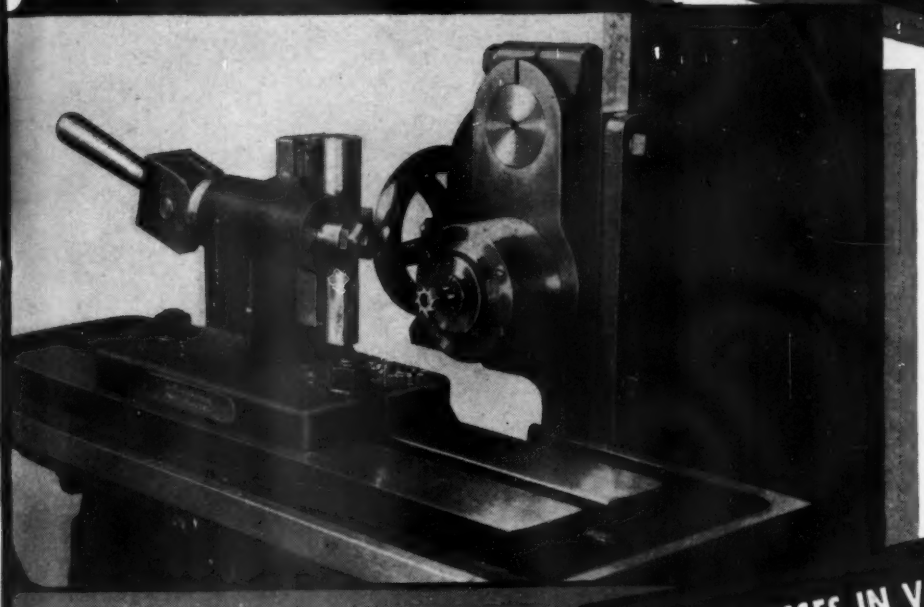
Here's another demonstration of how the speed, flexibility and easy handling of the No. 000 help to make the milling of small pieces more economical. This calls for a combination of facilities . . . fast easy set-up and adjustment – broad, independent ranges of speeds and feeds – and exceedingly rapid automatic table movements with ability to set trip dog for very short cuts and accurate reversal. Sound design and characteristic Brown & Sharpe manufacturing make the No. 000 Plain Milling Machine a safe investment over a long term of years. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN &

Milling slot with contour at bottom in brass fuze component. This is accomplished with a special tilting table fixture, the roll of which rides on the formed guide attached to the machine bed. The quick-acting clamp and the rapidity of table movement on the No. 000 completes this cut at an exceptionally fast rate. Cutting time is 35% of the cycle at 20⅛ in. per min. feed rate.



MILLING WOODRUFF KEY SLOT



Milling Woodruff key slot in a cast Meehanite shaft. This simple fixture locates and supports the piece, held by a cam-operated clamp. Uniformity of key slot depth is assured by the accurate table reversal of the No. 000. Cutting time, 48% of cycle; feed, 2 11/16 in. per min.

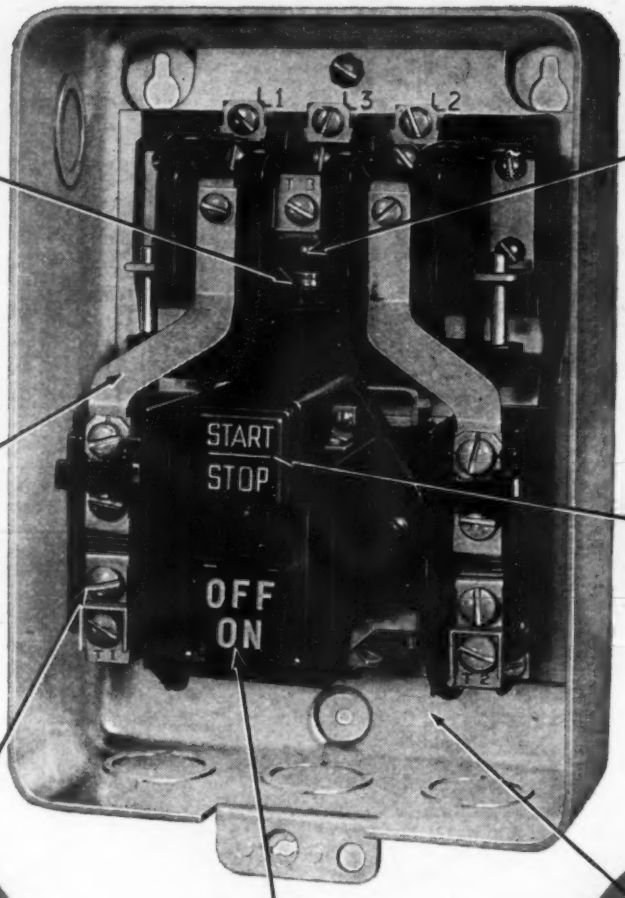
MILLING RECESSES IN VALVE PLATE

Milling two recesses in cast iron valve plate. Both cuts are completed with one clamping of the work because the trunnion-type fixture is manually indexed from one position to the other on successive movements of the table. Depth of cut is held to close limits by the No. 000's accurate table reversal. Total cutting time 29% of cycle. Feed rate is 6 11/16 in. per min.

SHARPE

B·S

How's THIS for a Starter?



MOVING CONTACTS (Double-Face)

STATIONARY CONTACTS (All Removable from Front)

JUMPERS (Added Rigidity)

SINGLE BUTTON START AND STOP

HEATERS FOR THERMAL OVERLOADS (Easily Accessible)

SIGNAL FLAG ON-OFF

AMPLE WIRING ROOM

Write for bulletin 200

MASTER A.C., across-the-line, magnetic MOTOR STARTER

THE MASTER ELECTRIC CO. MASTER **DAYTON 1, OHIO**

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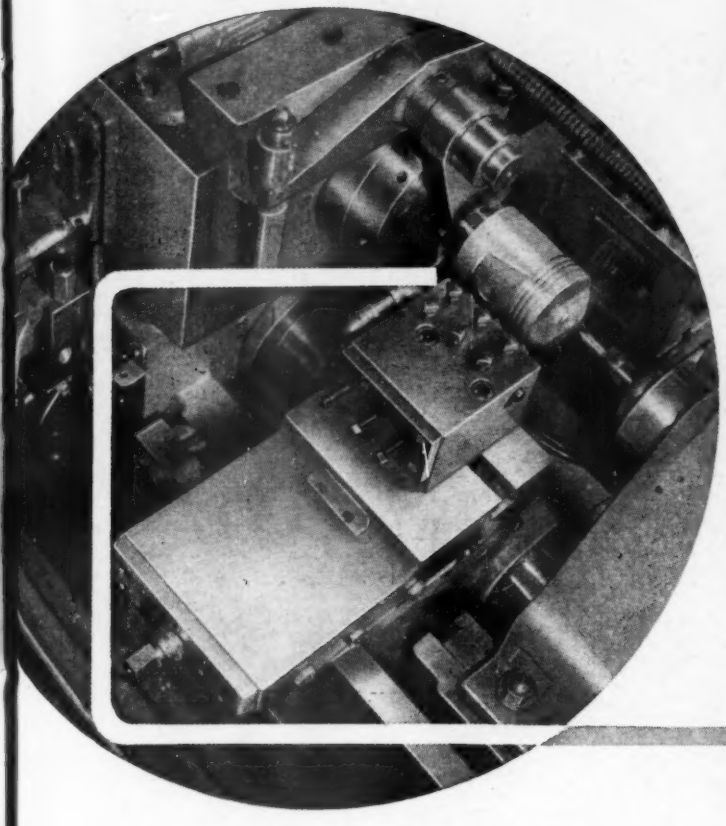
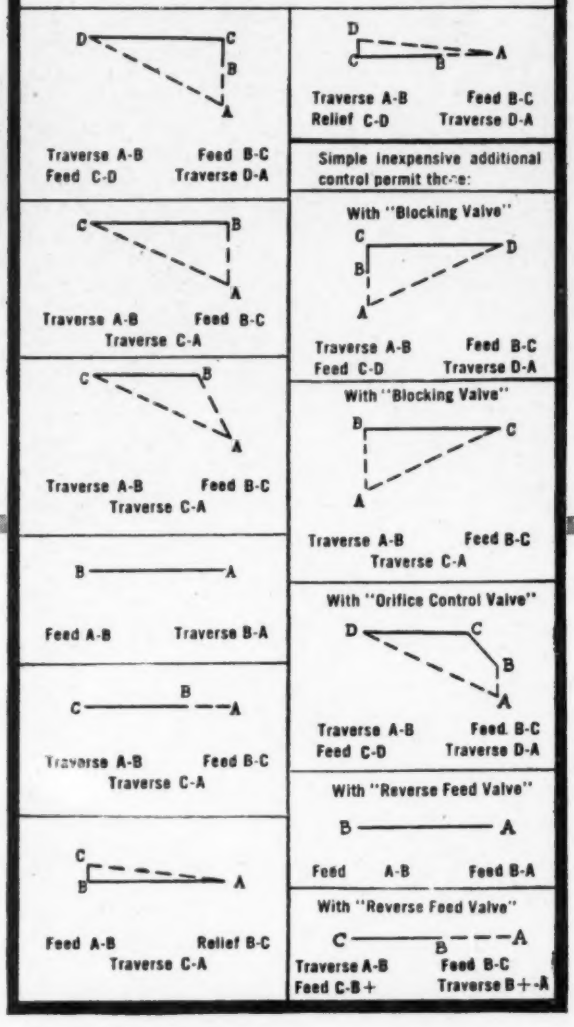
A DOZEN DIFFERENT MACHINING CYCLES

with the

FRONT CARRIAGE ALONE



THE FRONT CARRIAGE on the STANDARD No. 12 WILL PERFORM THE FOLLOWING CYCLES

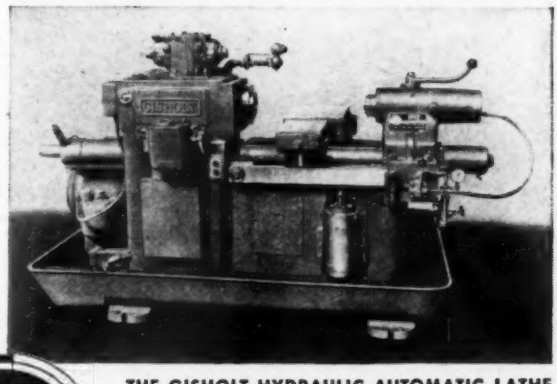


The Gisholt
YDRAULIC AUTOMATIC LATHE

e versatility of the front carriage on this automatic lathe ables you to solve a great number of machining problems the most efficient way.

Entirely hydraulic in operation, it permits many combina- ns of transverse and longitudinal motions at both feed and verse rates. Many special combinations are possible on this ndard machine. And still further variations may be obtained means of special hydraulic equipment or cam guided blocks. tandard taper attachment can be utilized with any of the nt carriage movements.

Versatility is only one of many outstanding advantages on Gisholt Hydraulic Automatic Lathe. If speed, accuracy and y operation can cut your costs on parts in large quantities on a wide variety of small lots, ask for full information.



THE GISHOLT HYDRAULIC AUTOMATIC LATHE *is a genuinely rugged 12" machine. It is completely automatic in operation, remarkably easy to set up, and ideal for between-centers or chucking jobs. Write for literature.*

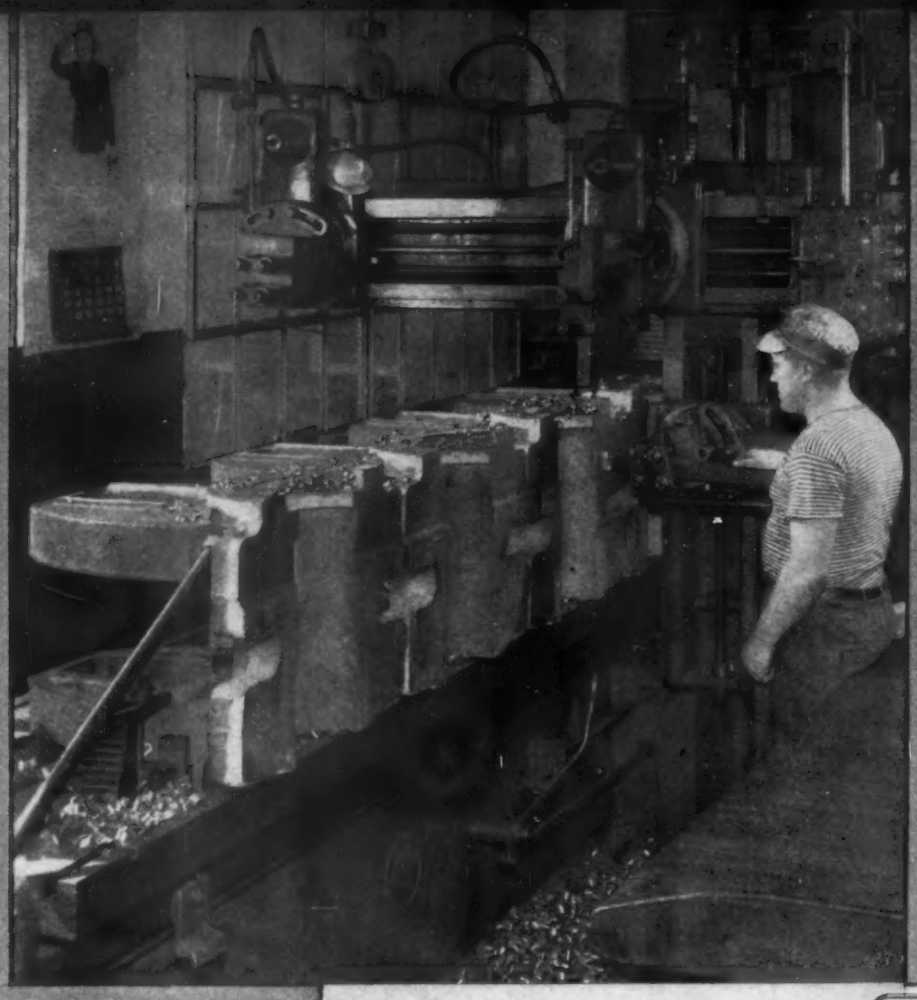
ISHOLT MACHINE COMPANY

1 East Washington Avenue • Madison 3, Wisconsin

ok Ahead . . . Keep Ahead . . . with Gisholt

GISHOLT

RET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Simplified Control

Quick Set-up

Fast Operation

Stepless Speeds

Smooth Cutting

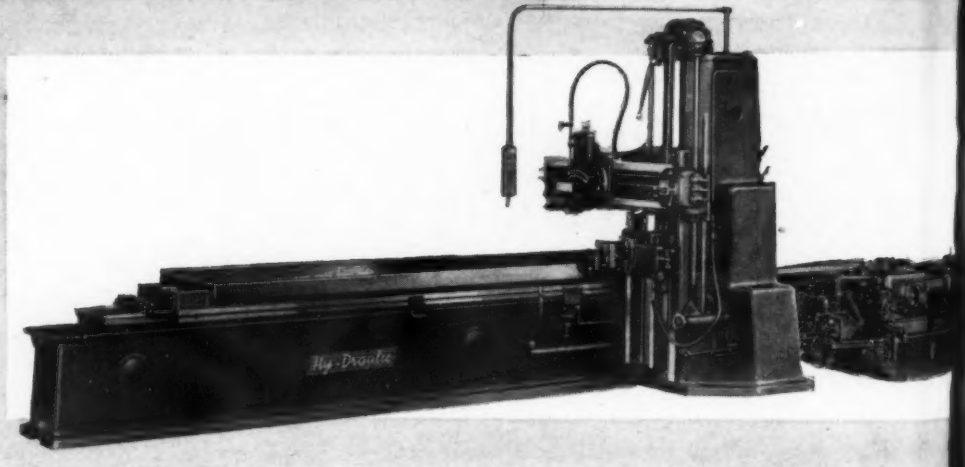
Fast Reversals

Long Tool Life

Because It's
HY-DRAULIC

Rockford Hy-Draulic Shaper-Planers

Built in five standard sizes with table stroke lengths ranging from 42" to 144", Shaper-Planers are equipped to your specifications with single or double cross rail head . . . and with side rail head.



4616

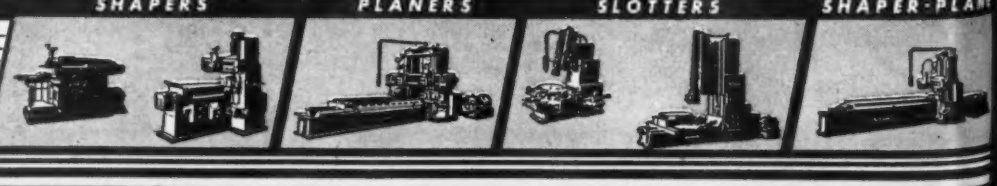
FASTER WORK on the "in-between" jobs . . . . . .

Because it's Hy-Draulic, the Rockford Shaper-Planer will give you faster work, on every type of shaper-planer job. The steel castings being machined above represent a typical application . . . work that is too small for standard planers, yet too large for shapers.

The reasons are many why Rockford Hy-Draulic Shaper-Planers hold "floor-to-floor" time to a minimum. Controls are centralized and responsive, speeding up both set-up and actual machining time. Cutting strokes may be quickly set for *any* length and speed required within capacity limits . . . reversals are fast. To help decrease your overall machining costs, we suggest you get the facts on Rockford Hy-Draulic Shaper-Planers. Ask for Bulletin 445.

ROCKFORD MACHINE TOOL CO.
ROCKFORD ILLINOIS

Hy-Draulic



A Story of 734 holes

.0002" spacing tolerances . . . 734 holes of varied diameter . . . in a 24" diameter circular drill jig!

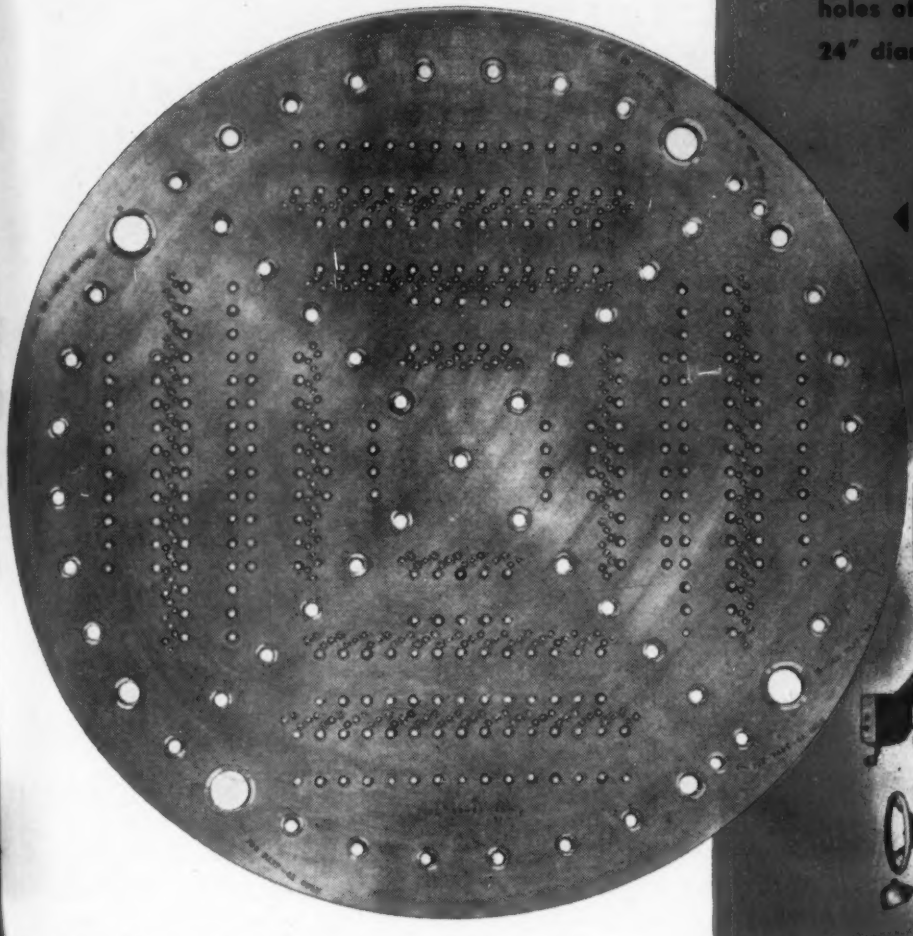


Photo courtesy of Potts Machine Co. Jackson, Michigan

Work like this calls for extra-close precision boring . . . the kind possible only with a precision-built jig borer.

Jobs like this are all in the day's work for the tool shop equipped with a Pratt & Whitney Jig Borer. The built-in accuracy of this precision machine is passed on to every job it does.

Pratt & Whitney equipped shops can meet your *exact* specifications for accuracy in tools, dies and jigs, at marked savings to you.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

Here's How To Get More Output Per Grind, Longer Life From Your Tools!

First: Your tooling costs drop with every extra piece your tools produce per grind, every extra hour they stay on the job. That's why it pays you to use the Carpenter Matched Set Method of tool steel selection. This tried and proved method enables you to know *in advance* what performance to expect from the tool steel you use. Quickly and easily, it helps you select the tool steel best suited for the job. The result is longer tool life, more output per grind—lower tooling costs!

Second: For additional help in getting the kind of tool performance you want, get in touch with your nearby Carpenter representative. From the very start of your tooling job to its completion, he can give you all the information you need to put the Matched Set Method to work in your plant. So contact your Carpenter representative—just call your nearby Carpenter Warehouse or Distributor, today.

THE CARPENTER STEEL COMPANY, 109 W. Bern Street, Reading, Pa.

Use the Matched Set Method for Results Like This:

Hours of Machine Down-time Eliminated Per Week: 11!

Extra Pieces Produced Per Grind: 550,000!

the Job: Blanking and forming Thermostat Diaphragms from .008" thick phosphor spring bronze.

the Problem: The nature of the material required tools with exceptionally sharp cutting edges. With the steel previously used, tools required too frequent regrinding and each time they were reground, 1½ hours of productive machine time were lost.

the Results: The tool maker, using the Matched Set Method, went to Carpenter *Hampden* (Oil-Wear) for greater wear resistance. The new *Hampden* punch eliminated *11 hours* of machine down-time each week and produced *550,000 additional* diaphragms per grind!

Call YOUR NEARBY CARPENTER WAREHOUSE OR DISTRIBUTOR TODAY FOR FAST DELIVERY OF --

Carpenter ® MATCHED TOOL STEELS

†Baltimore	*Cleveland	†Los Angeles	†San Francisco
†Birmingham, Ala.	*Dayton	*New York	†Seattle
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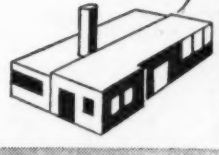
*Buffalo	*Hartford	†Portland, Ore.	*In Canada:*
*Chicago	†Houston	*Providence	†Toronto and
*Cincinnati	*Indianapolis	*St. Louis	†Montreal

*Carpenter Warehouse † Carpenter Distributor

See Your Classified Telephone Directory

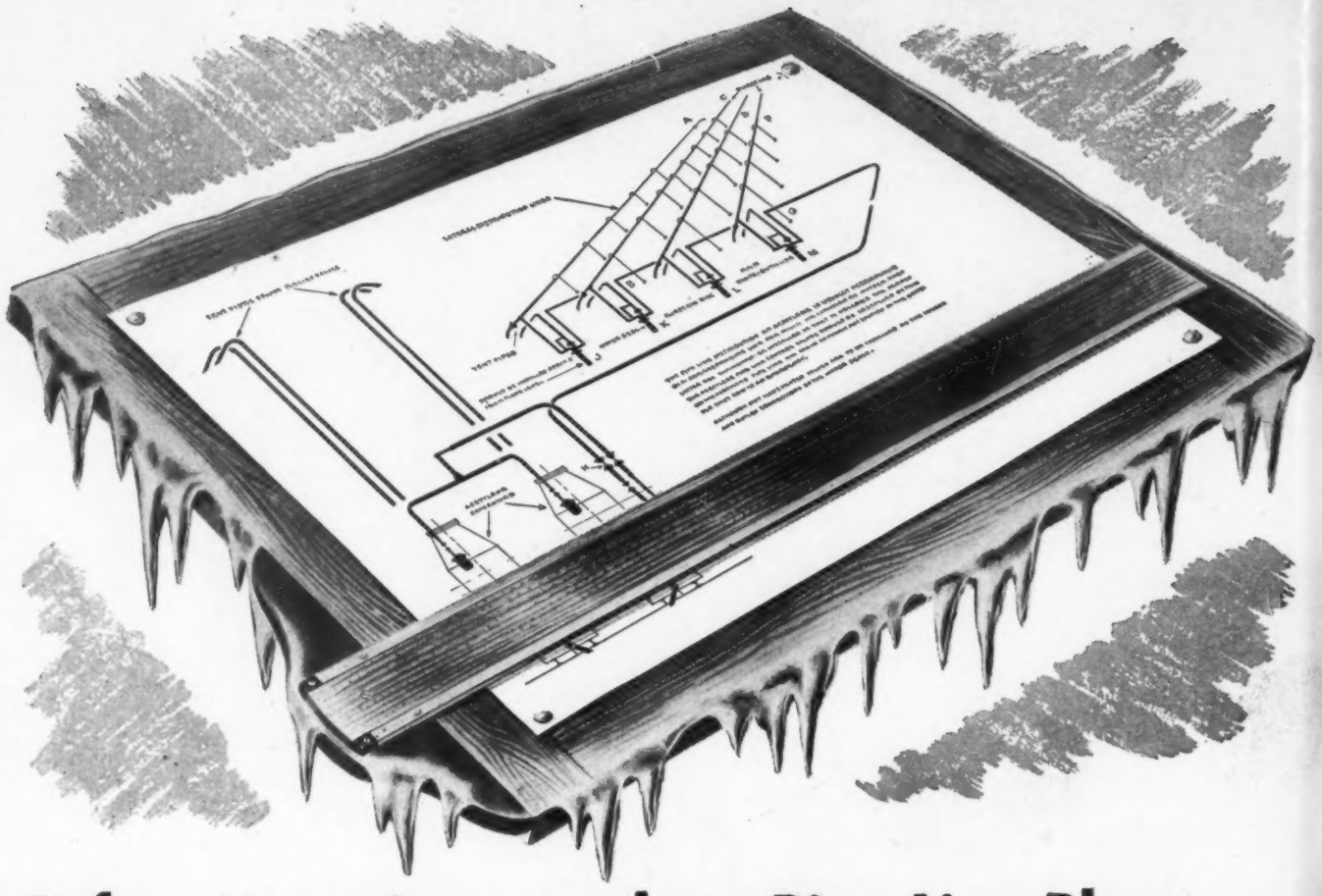


Carpenter

MATCHED TOOL STEELS

100% ACID DISC INSPECTED

WARRANTED CLEAN DIOK SOUND UNIFORM



Before Your Oxyacetylene Pipe Line Plans

Are Frozen...

LET THESE TWO INVALUABLE BOOKS HELP YOU

From the moment you begin to visualize pipe line needs, Airco's book, "Planning Your Oxyacetylene Installation" will prove an immense aid. It was compiled by Airco technicians, who know from experience the problems that will confront you while planning your pipe lines. The writers point the way to save money and time . . . to avoid costly mistakes . . . to install a system planned to give long, economic service. They help you to plan now for an installation not only adequate for today's loads . . . but also capable of meeting greater demands when needed. You'll find this book invaluable. It anticipates your questions and arranges the answers so you can turn right to them.

Forty-two pages jam-packed with facts, figures and illustrations thoroughly covering your problems . . . yours for the asking.

You will also want to review the new Airco Catalog No. 30. It describes the complete Airco line of acetylene generators, gas distributing manifolds, station regulators, and special protective devices which are vital elements of a pipe line system. Fill in the coupon and mail to: Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Co., General Offices, Houston 1, Texas. Represented Internationally by Airco Export Corporation.

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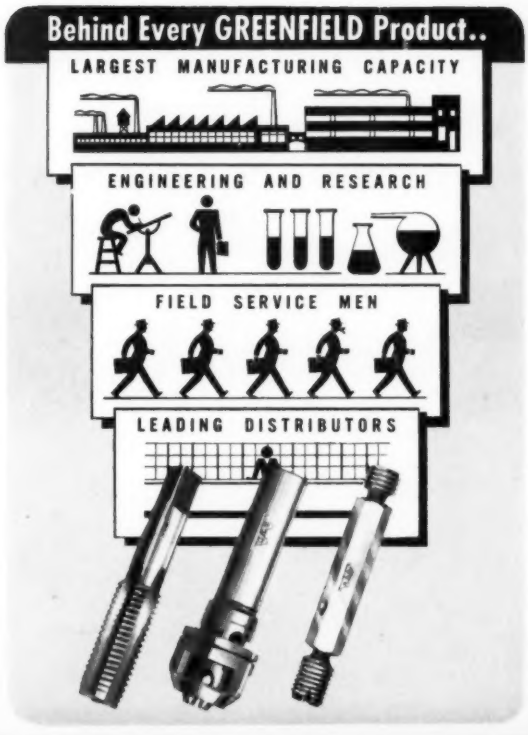
"Son, we've got a world reputation to keep"

"When this tool is finished, it will carry the G.T.D. mark. And that mark stands for quality in every machine shop in the world—from Detroit to Delhi, from Quebec to Capetown. When I came to work here 27 years ago, "Greenfield" was world famous for its threading tools. Yet those tools we made then were crude beside the ones you're working on right now. It's up to you, son, to keep making better and better tools so that when you're my age people will still be saying, *'You get more for your money when you buy from "Greenfield".'* Good luck, son."



G.T.D. GEOMETRIC

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

Precision

THREADING TOOLS

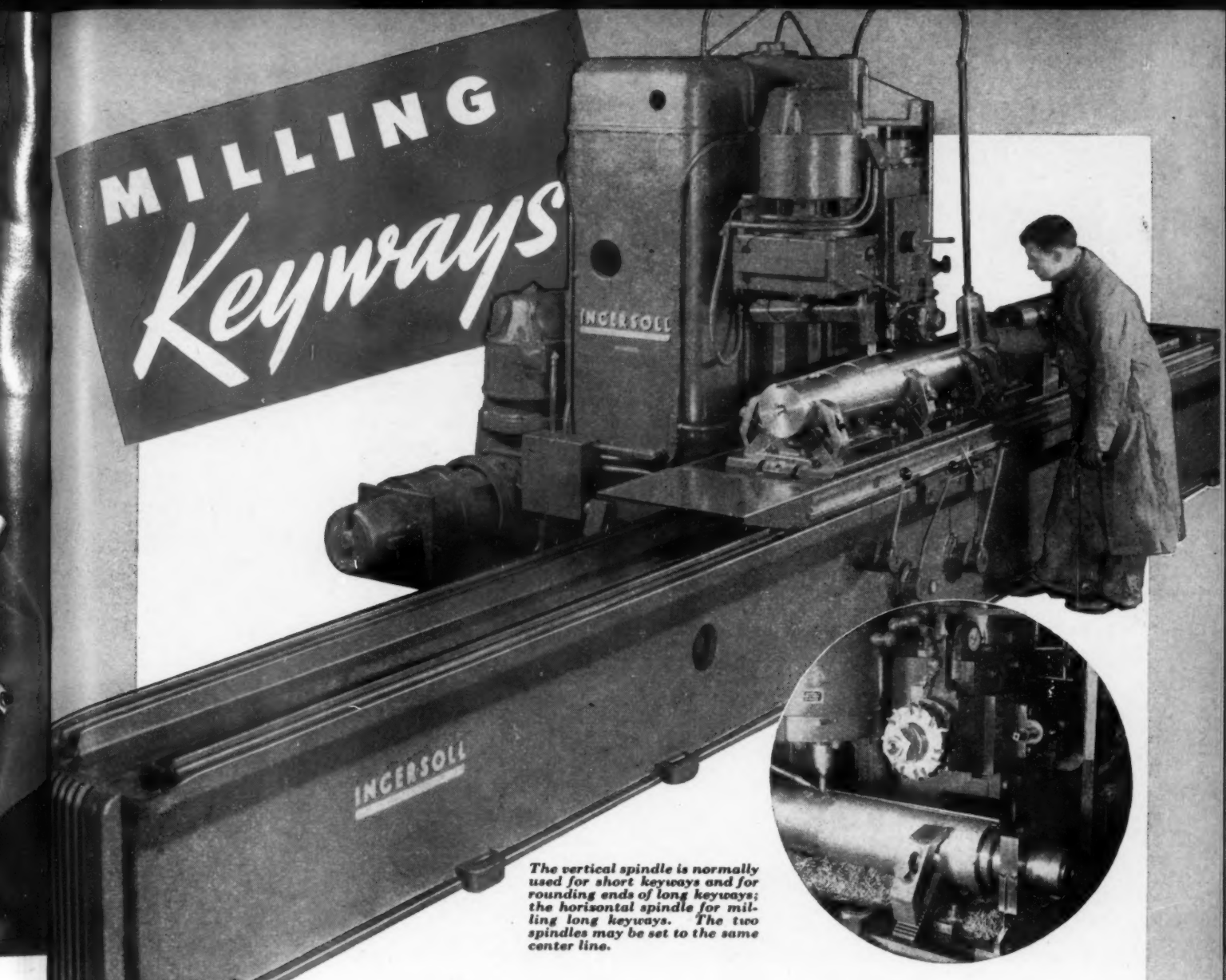
THE

GEOMETRIC

TOOL COMPANY . . NEW HAVEN 15, CONN.

A Division of Greenfield Tap and Die Corporation

MILLING *Keyways*



The vertical spindle is normally used for short keyways and for rounding ends of long keyways; the horisontal spindle for milling long keyways. The two spindles may be set to the same center line.

SPECIALLY DESIGNED

- This machine was specially designed to mill wide keyways in large diameter shafts or cylinders. Keyways up to 2½" wide by 12′ long may be cut at a single setting. Both the horizontal and vertical spindles are heavy and rigid. The resulting work is so accurate that it greatly reduces hand fitting.

- It is our business to design and build special purpose metal-cutting machines, tools, and work holding fixtures. We combine experience of over 50 years with a strictly up-to-the-minute approach to all problems that are presented to us. We will gladly discuss your needs with you.

INGERSOLL

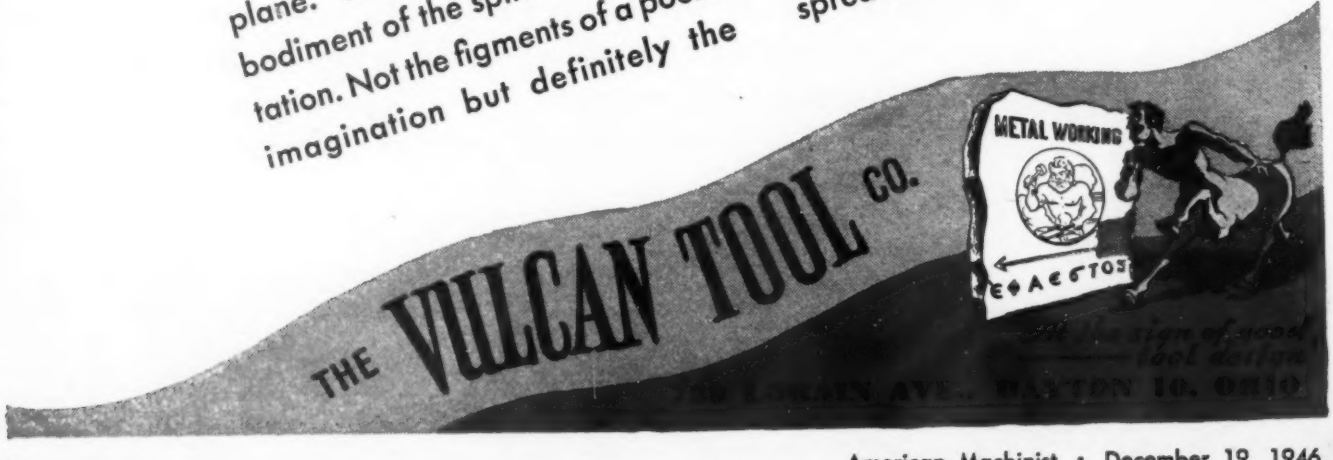
THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

THERE IS A REINDEER THAT BRINGS GIFTS

Everyone has read reprints of the New York Sun's classic editorial letter to a little girl named Virginia assuring her there is a Santa Claus, while proving to adult minds that the spirit of Christmas is real.

Yes, Virginia, there is also a team of reindeer that delivers packages to forty million firesides on Christmas morning. Their names are boat, and train, and truck, and plane. They are the visible embodiment of the spirit of transportation. Not the figments of a poet's imagination but definitely the dream children of many tool designers. In fact, your gifts themselves and their unbelievable abundance are the creation of special tools.

Yes, manufacturers, your customers pay for your product, but in a larger sense your product is your employees' gift to society. Their labor and often their love goes into it. Almost certainly if you study the manhours you will find new places where special tools could multiply their production and spread their 1947 gift more widely.



SUPERFINISHING

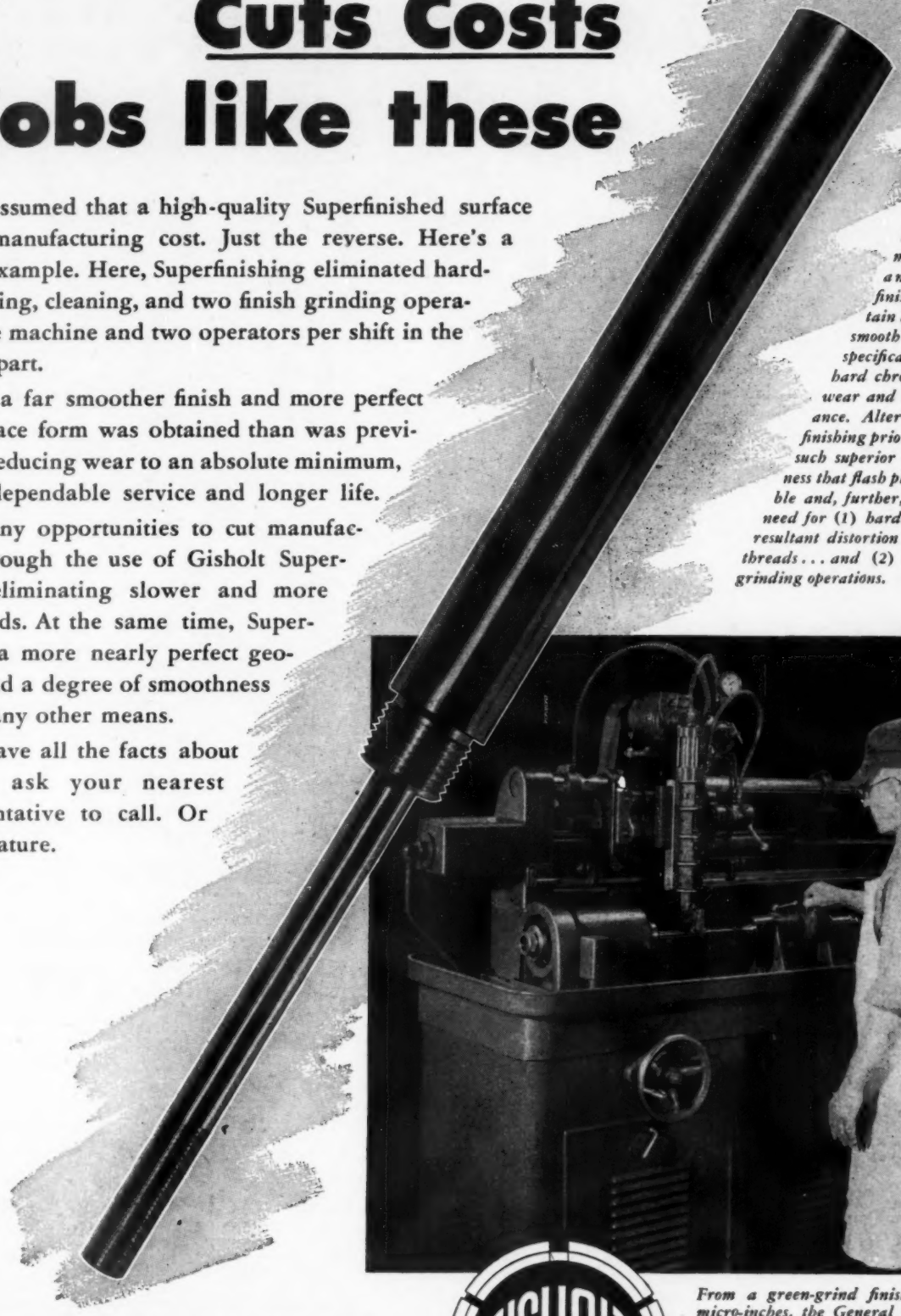
Cuts Costs on jobs like these

You may have assumed that a high-quality Superfinished surface would add to manufacturing cost. Just the reverse. Here's a piston rod, for example. Here, Superfinishing eliminated hardening, straightening, cleaning, and two finish grinding operations, saving one machine and two operators per shift in the finishing of this part.

What's more, a far smoother finish and more perfect geometrical surface form was obtained than was previously possible, reducing wear to an absolute minimum, assuring more dependable service and longer life.

There are many opportunities to cut manufacturing costs through the use of Gisholt Superfinishing — by eliminating slower and more laborious methods. At the same time, Superfinish produces a more nearly perfect geometrical form and a degree of smoothness not possible by any other means.

If you don't have all the facts about Superfinishing, ask your nearest Gisholt representative to call. Or write us for literature.



This S. A. E. 1020 steel piston rod was formerly hardened and given two finish grinds to obtain an exceptionally smooth surface, while specifications called for hard chrome plating for wear and corrosion resistance. Alternatively, Superfinishing prior to plating gave such superior surface smoothness that flash plating was possible and, further, eliminated the need for (1) hardening—with its resultant distortion and damage to threads . . . and (2) two subsequent grinding operations.

From a green-grind finish of 18 to 27 micro-inches, the General Purpose Superfinisher on this job produced a surface smoothness of 3 to 5 micro-inches, with controlled accuracy, and prepared the part for fast chrome plating. Investigate the possibilities of Superfinishing in your shop work!

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison 3, Wisconsin

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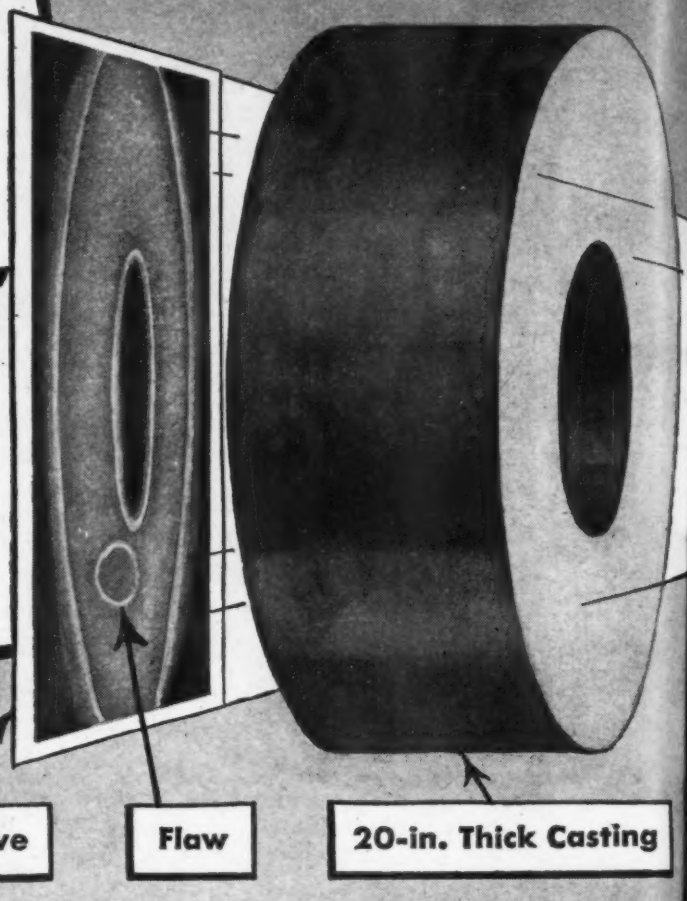
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

X-rays through 20 in.

ALLIS-CHALMERS ANNOUNCES 20,000,000 VOLT BETATRON!



Generating X-rays 10 Times More Powerful than Any Before Used in Practical Industrial Radiography, A-C's Betatron X-rays Thicker Metal Sections Accurately and at High Speed . . . Detects Flaws in Castings, Forgings, Welds, Assemblies!

PICATINNY ARSENAL, Dover, N. J. — Information has been released concerning the successful operation of the 20-million volt Allis-Chalmers betatron installed here.

Second A-C unit developed for government arsenals, it is being used for radiographic inspection of ordnance. Operation is completely automatic, with one man controlling the entire unit.

Significance of this first commercially practical X-ray instrument employing extremely high energy X-rays is that now, for the first time, larger, thicker metal sections can be X-rayed with great accuracy and high speed, penetration of metal has been extended to as deep as 20 inches.

HAS BROAD INDUSTRIAL APPLICATION

The new 20-million volt betatron enables radiographing entire assemblies — individually or on a continuous-line basis — to check parts alignment, tolerances, etc. It can reveal — in advance of costly machining — shrink, metal concentration, etc., in castings, steel parts, billets. On welds, it can detect lack of fusion, porosity and cracks.

CUTS X-RAY TIME FROM HOURS TO MINUTES

Through higher energy X-radiation, it has greatly reduced time required for exposure. For example, a cavity located anywhere in a 13-inch forging is revealed clearly and precisely in less than a 1-minute X-ray exposure. Normally with conventional lower voltage machines, hours are required to penetrate through 7 or 8 inches of heavy metal.

Characteristics of 20-million volt X-rays as contrasted with lower energy rays, offer still further advantages for both thick and thin section, individual or production-line radiography of metals.

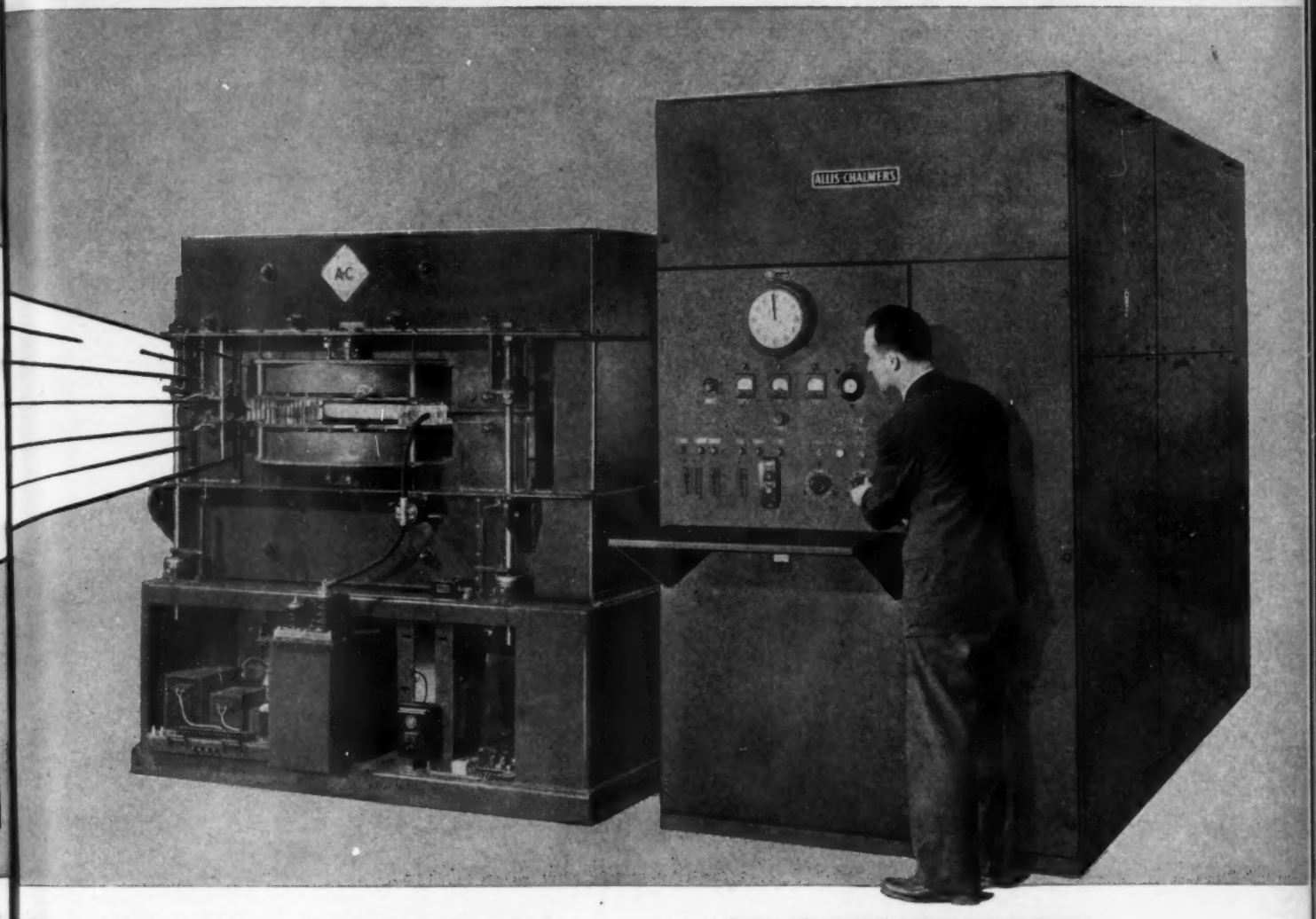
☛ ***Maximum Penetration,*** in case of thick sections, without loss of detail on steel, brass, copper, bronze, etc.

☛ ***Absolute Sensitivity.*** A flaw of $\frac{1}{32}$-inch is detectible in steel thicknesses from 2 to 12 inches. From 12 to 20 inches the minimum detectible flaw is $\frac{1}{10}$-inch.

ALLIS CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

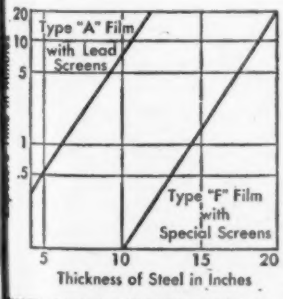
Steel in 20 Minutes!



☛ ***Increased Latitude.*** It is now practical to radiograph, on one film, a specimen of varying thickness, without having to make several different intensity exposures.

☛ ***No Blocking*** required around outline of an irregular section. Extremely low intensity of secondary radiation enables sharpness of detail not otherwise attainable.

☛ ***Simplified Protection.*** Maximum intensity is in direction of electron stream at time it strikes the target. Result: maximum protection is required only in the forward direction of the X-ray beam.



HART SHOWS EXPOSURE TIME required for varying metal thicknesses ith two most commonly used film ypes. Target to film distance, 4 ft.

HEART OF BETATRON is this annular vacuum chamber, popularly called the "donut."

BASIC PRINCIPLES EASILY UNDERSTOOD

Technically a betatron is an instrument which accelerates electrons to very high energies, producing X-rays of 20-million volts energy. Basically, it may be compared to a conventional transformer. Electrons are accelerated in the same manner as a voltage is induced in the secondary of a transformer. However, in place of the secondary a ring-shaped vacuum tube is employed within which electrons are caused to rotate at continuously increasing velocity until they have attained 20-million volts of energy. At this point they are caused to strike a platinum target, and give up their energy in the form of 20-million volt X-rays — *one of mankind's most promising tools in the fields of industrial radiography, medical therapy and nuclear physics research!*

SEND FOR FREE BETATRON BULLETIN!

Explains basic principles of X-rays and radiography. Develops theory and practical application of betatron. Send for this valuable addition to your technical library today!

A 2136

ALLIS-CHALMERS, Milwaukee 1, Wisconsin.

Gentlemen:
Yes, I would like to receive a copy of "Allis-Chalmers 20-million volt betatron" Bulletin 01B6684

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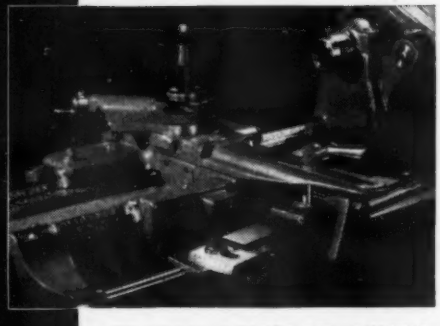
20,000,000-volt Betatron

SOUTH BEND LATHES

For Accuracy
Versatility
Dependability



TELESCOPIC TAPER ATTACHMENT
For 10", 13", 14½", and 16"
South Bend Lathes

This and other South Bend Lathe Attachments and Accessories permit quick tooling for a wide variety of precision machine work. Write for free Catalog 77. No obligation.

South Bend Lathes combine three distinguishing features which have won for them the acclaim of discriminating machine tool users everywhere:

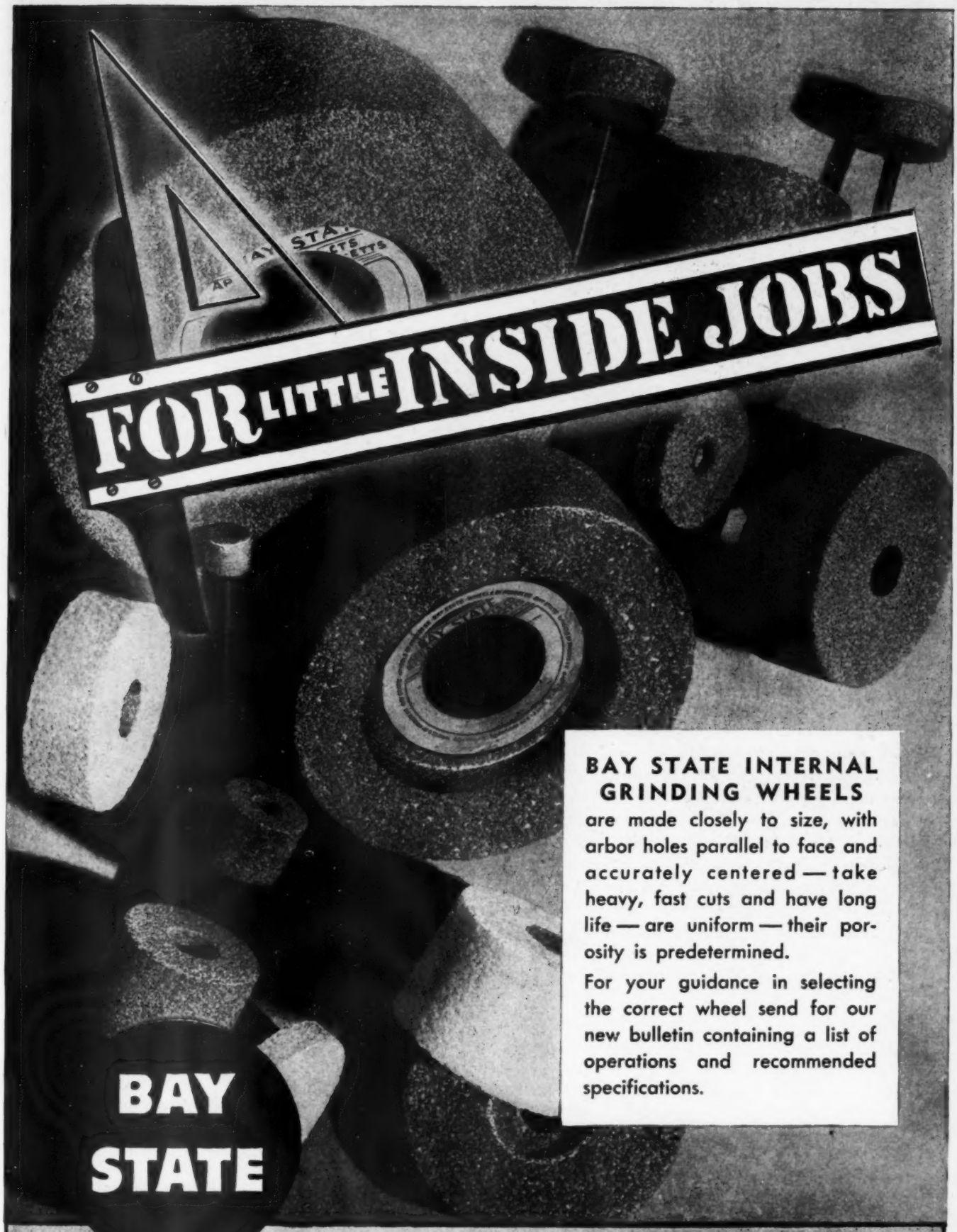
» Accuracy that permits working to close tolerances and machining work with such smoothness that often one or more finishing operations can be eliminated.

» Versatility to perform a wide variety of precision operations easily, quickly, and economically that otherwise would require installation of additional equipment.

» Dependability achieved through careful design and rugged construction assures day-in, day-out, trouble-free performance at low cost long after the installation has repaid its original cost.

Write today for Catalog 100-D which illustrates the entire line of South Bend Precision Lathes in full color and gives complete, detailed specifications of each model.

SOUTH BEND LATHE WORKS
419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA
LATHE BUILDERS SINCE 1906

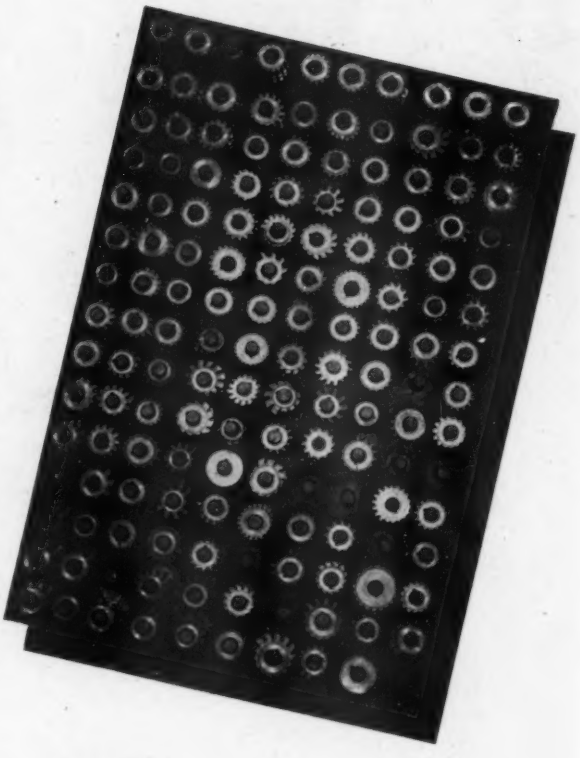

FOR LITTLE INSIDE JOBS
BAY STATE INTERNAL GRINDING WHEELS
are made closely to size, with arbor holes parallel to face and accurately centered — take heavy, fast cuts and have long life — are uniform — their porosity is predetermined.
For your guidance in selecting the correct wheel send for our new bulletin containing a list of operations and recommended specifications.
BAY STATE
Top Performance Consistently Duplicated
BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

WIDE VARIETY OF HOBS AND CUTTERS SHARPENED ACCURATELY ON...

BARBER-COLMAN

HOB SHARPENING MACHINES

When hobs and form cutters are resharpened to proper tolerances, consistently accurate work, finer finish and longer tool life result. Barber-Colman *Automatic* Hob Sharpening Machines enable the user to hold original tool accuracy throughout the life of the cutting tool. Tools with high helix angles, right or left hand, with shank or taper forms are all adaptable. Because all sharpening functions are brought under *positive mechanical control,* more accurate, faster sharpening is possible, and machine operators spend less time on the actual sharpening operation. The picture at the right shows the variety of work done on the machine shown above.



ONE SHARPENER SERVES ENTIRE DEPARTMENT

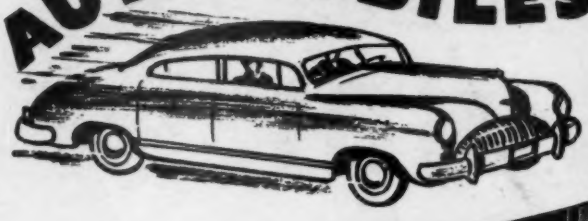
This machine — a No. 4 Automatic — fills all sharpening requirements in a department containing 20 hobbing machines and 2 thread millers. It has been in service for 6 years and the operator says it is the fastest and easiest machine to change over from one job to the next that he has ever handled. If you are interested in reducing your cutting tool costs, ask your Barber-Colman representative to check your needs and recommend a Barber-Colman Automatic Hob Sharpening Machine that will do just that.

BARBER-COLMAN COMPANY

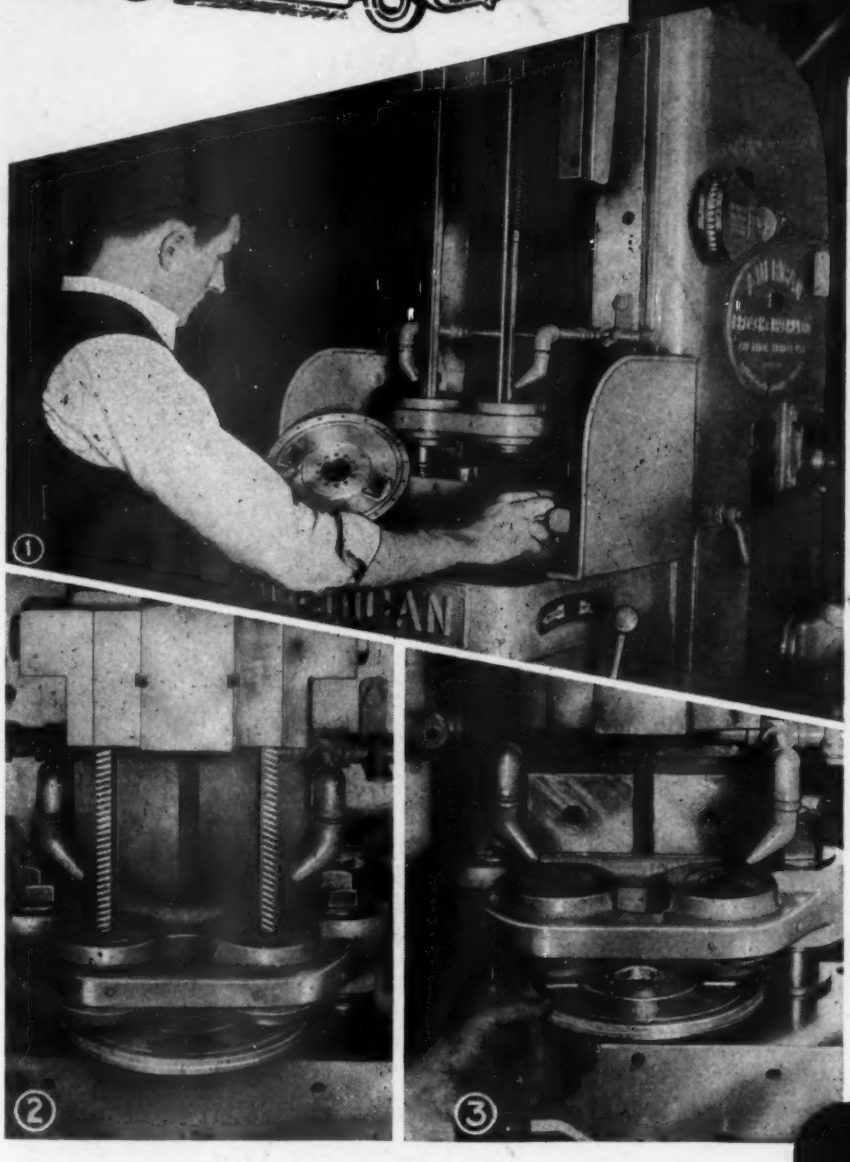
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

AUTOMOBILES



BUILT BETTER *Because of* BROACHING BY *American*



AMERICAN has designed and built broaching equipment to help form an endless procession of automotive parts. Among the countless pieces manufactured with the help of *American* broaching machines are transmission, steering, generator, differential, hydraulic, ignition, and brake parts, cams, cylinder blocks, gears, and connecting rods.

American's service to industry is three-fold. *American* makes broaching machines and broaching tools; *American* engineering talent is at your service to devise the means of making this equipment useful to you. Write today for further details.

A typical job, perfo med on a standard *American* T-6-24 broaching machine, is broaching three sides in each of two holes of a diaphragm mounting plate. **Fig. 1** shows the operator about to load and clamp the part in the fixture. Broaches are at upper end of stroke. **Fig. 2** illustrates the machine midway in the broaching cycle. **Fig. 3** shows the part automatically ejected at the end of the broaching stroke. Broaches are returned to "up" position before next part is loaded. The complete cycle takes less than 30 seconds, including loading and unloading.

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

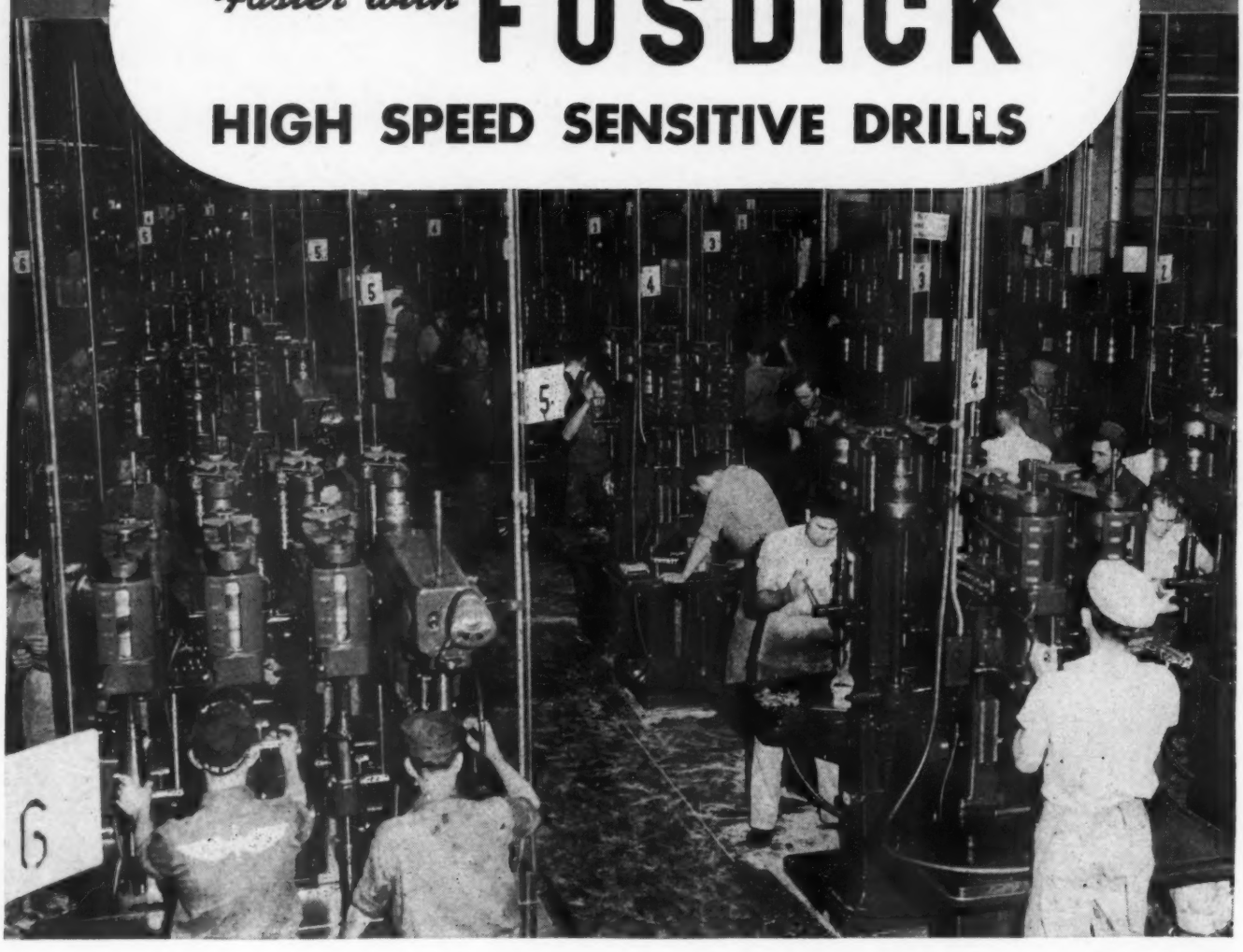
ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

More Holes Drilled—Bored—Reamed
Faster with **FOSDICK**
HIGH SPEED SENSITIVE DRILLS



● On work requiring drilling, reaming, or boring of holes up to 1½" diameter, you will find Fosdick High Speed Drills surprisingly economical.

The simplicity of operation permits the use of unskilled help and still enables you to get maximum production. Six spindle speeds ranging from 225 to 1800 R. P. M. is standard but special ranges can be supplied.

These machines are available in any number of spindles up to six and different operations may be performed on each spindle.

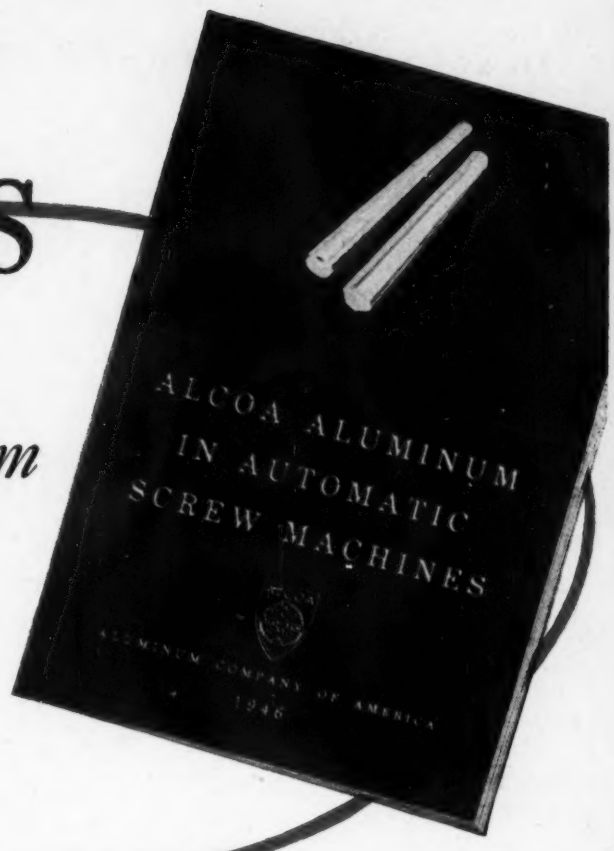
For example on a battery of machines like the one illustrated a reverse mechanism may be added for tapping operations and requires only the addition of a contactor to the controller.

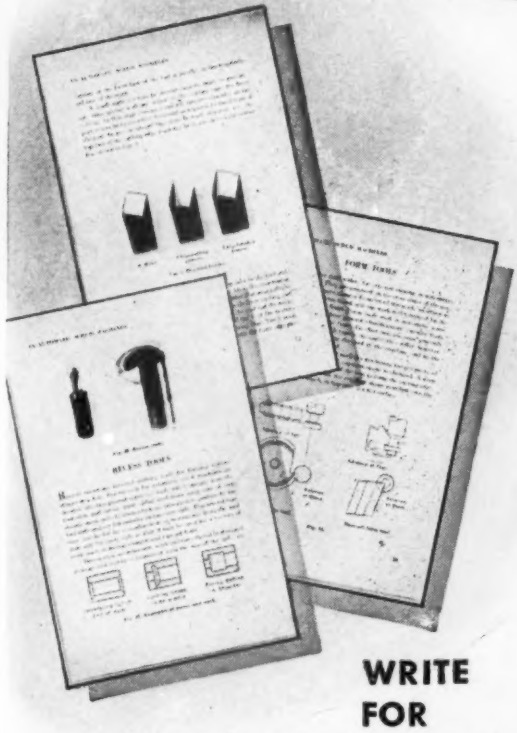
Consult a Fosdick representative on your small hole drilling, reaming and boring operations for high production and low costs. Bulletin High Speed Drills H. S. A. gives all the details. *Write for it.*

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ... OHIO

87 pages

to help you use Alcoa Aluminum in Automatic Screw Machines





WRITE FOR YOUR COPY TODAY

Just off the press, this new booklet "Alcoa Aluminum in Automatic Screw Machines" is chock-full of information for machine operators, production engineers and designers.

Every subject, from the composition of Alcoa Aluminum Alloys most suitable for screw machine work, to details of skiving and knurling, is covered. Each class of tools is discussed in separate chapters. There is also a chapter on Finishes for aluminum screw machine parts.

This new booklet is one in the series of "how-to-do-it" manuals that comprise the Alcoa Technical Library. Each booklet in this series is written to help you to use Alcoa Aluminum Alloys to the best advantage and most economically. Alcoa's half-century of experience and know-how in working with aluminum in *all* its forms is offered to you and your people . . . another of Alcoa's technical and engineering services to users of Alcoa Aluminum.

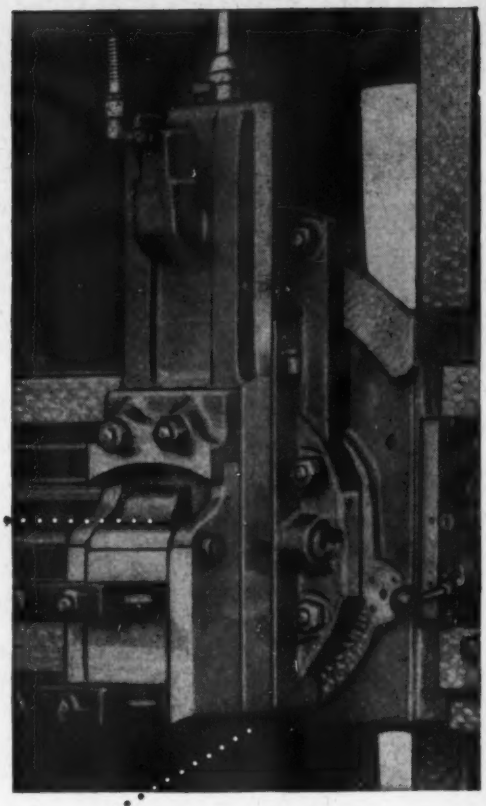
A letter will bring you a copy of "Alcoa Aluminum in Automatic Screw Machines". Address ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in principal cities.

ALCOA FIRST IN **ALUMINUM**

IN EVERY COMMERCIAL FORM

Both in the Hypro rail head

. . . these exclusive Hypro dependable features

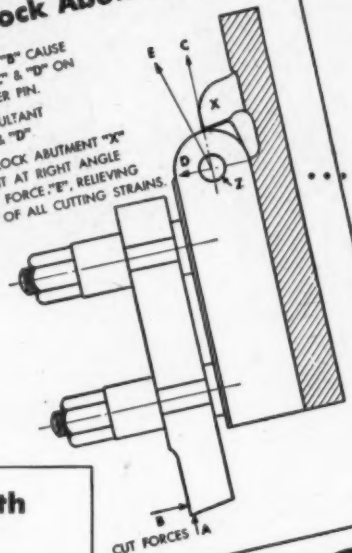


Exclusive Cincinnati Hypro Tool Block Abutment

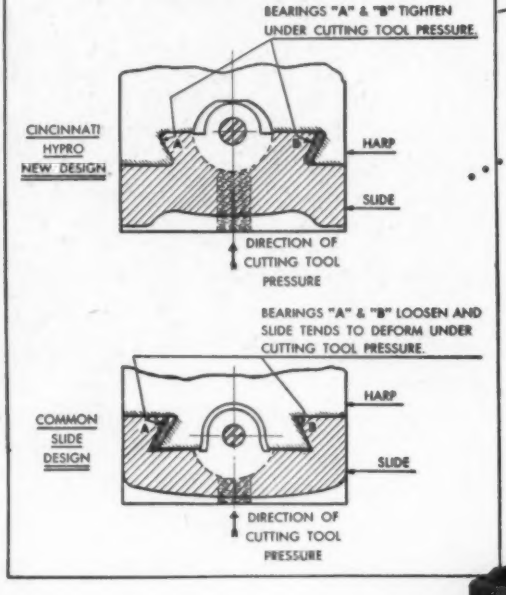
(1.) CUT FORCES "A" & "B" CAUSE ACTING FORCES "C" & "D" ON CLAPPER BOX TAPER PIN.

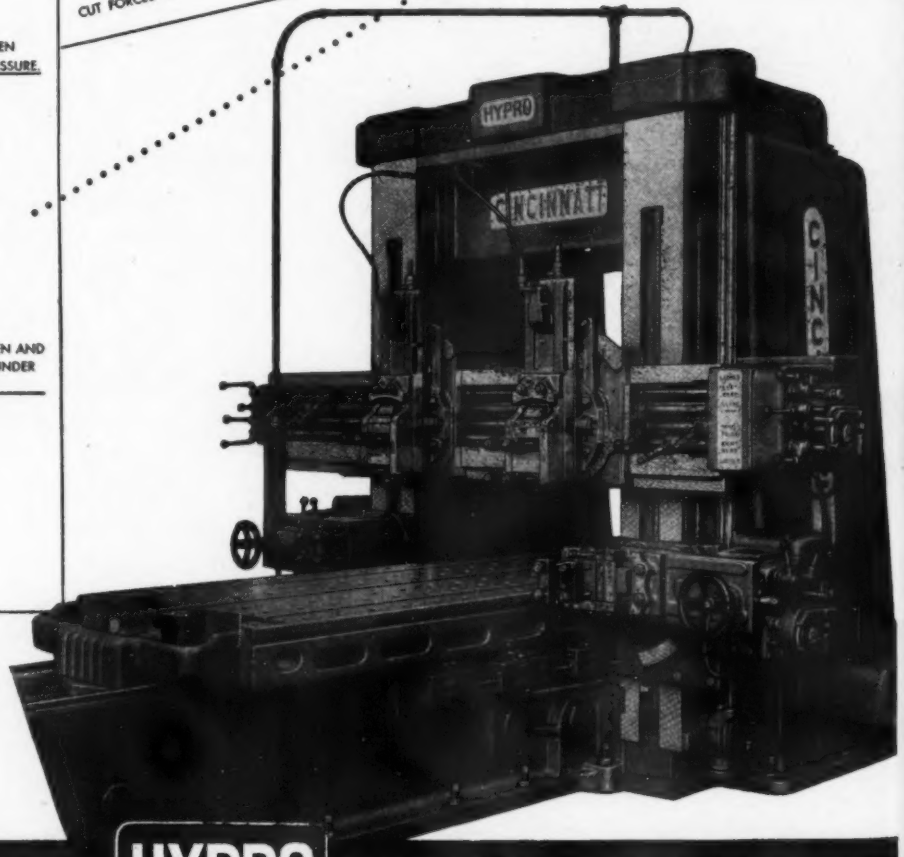
(2.) FORCE "E" IS RESULTANT OF FORCES "C" & "D"

(3.) HYPRO TOOL BLOCK ABUTMENT "X" IS PRECISION FIT AT RIGHT ANGLE TO RESULTANT FORCE "E", RELIEVING TAPER PIN "Z" OF ALL CUTTING STRAINS.



Full Bearing Slides with Inverted Dove-tail


BEARINGS "A" & "B" TIGHTEN UNDER CUTTING TOOL PRESSURE.
CINCINNATI HYPRO NEW DESIGN
HARP
SLIDE
DIRECTION OF CUTTING TOOL PRESSURE
BEARINGS "A" & "B" LOOSEN AND SLIDE TENDS TO DEFORM UNDER CUTTING TOOL PRESSURE.
COMMON SLIDE DESIGN
HARP
SLIDE
DIRECTION OF CUTTING TOOL PRESSURE



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Interested in Adding 50% to Cutter Life?

Because it is a radically different kind of cutting fluid . . . a chemical emulsion which combines cooling capacity and friction reduction in a degree never before attained . . . Cimcool has produced amazing increases in tool life in plant after plant. May we demonstrate what it will do in YOUR plant?

Other CIMCOOL *Advantages*

- Uniform work temperature increases accuracy.
- No fire hazard—No smoke—No slippery film.
- Faster cooling allows faster cutting.
- Non-irritating—Doesn't grow rancid.
- Covers 85% of all metal working jobs.
- Contains long-lasting rust inhibitor.

Cutter life increased at least 50% says Thompson Industries, Inc. of Long Island City, N. Y.

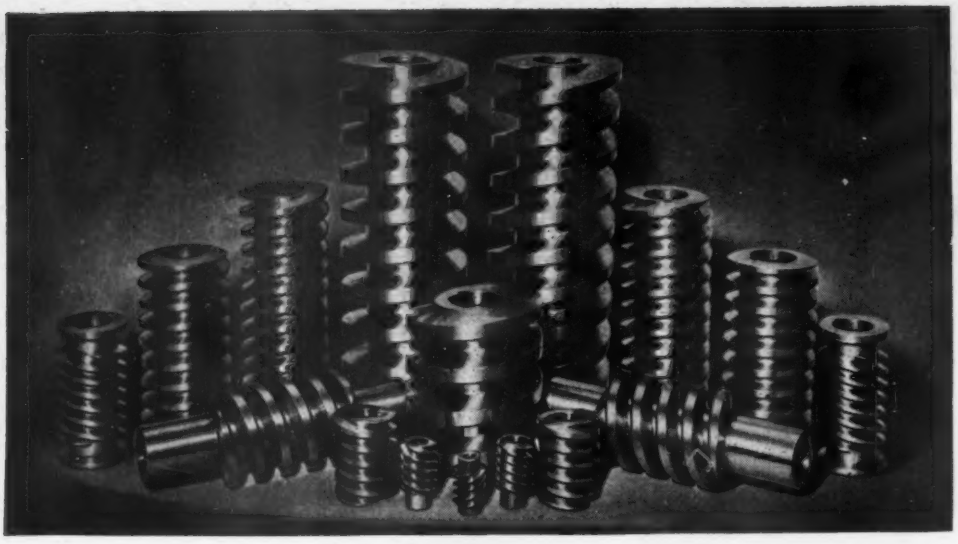
Here's what the company writes about Cimcool: "In our grinding operation, our wheels do not load up so rapidly, thereby increasing wheel life and giving a better finish on the work. Also, in our hobbing machines, cutter life has been increased at least 50% between sharpening."

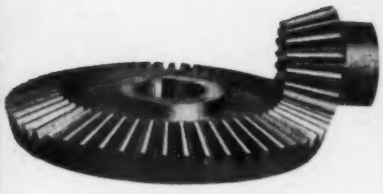
CIMCOOL DIVISION OF
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

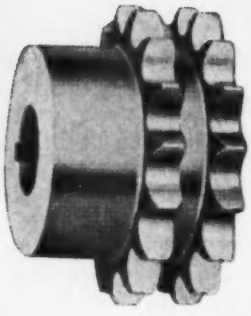
CIMCOOL

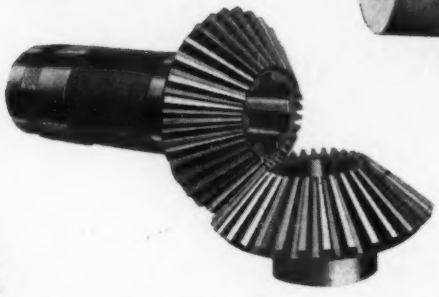
Reg. U. S. Pat. Off.

THE MULTI-PURPOSE CUTTING FLUID









GEARS

Spur Gears
Helical Gears
Splined Shafts
Worms
Worm Gears
Bevel Gears
Miter Gears
Sprockets
Ratchets
Racks
Lead and Feed Screws

EXPERIENCE AND FACILITIES ASSURE UNIFORMITY AND ECONOMY . . .

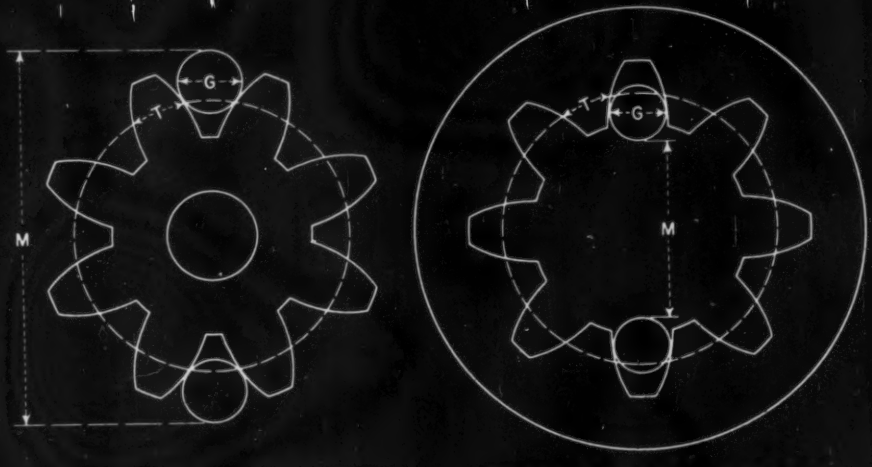
We are specialists in the production of GEARS for individual needs and are prepared to give you full and complete cooperation.

Our 63 years of manufacturing experience can be of advantage to you. ADAMS GEARS are made with strict adherence to your specifications and close limits of accuracy are assured.

Consult with an ADAMS GEAR expert for your next requirements.

The ADAMS COMPANY
DUBUQUE, IOWA
ESTABLISHED 1883

Van Keuren



EXTERNAL SPUR GEAR **INTERNAL SPUR GEAR**

SIMPLE . . . The only calculation required is one of simple division.

RELIABLE . . . The system is favored by outstanding American Gear Manufacturers.

ACCURATE . . . The Van Keuren Gear Tables are complete for gears from 5 to 500 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. If the measurement over the wires is greater than the value calculated from the tables, the tooth is too thick and cutter must be fed further into the gear blank. Exact constants for controlling tooth thickness and backlash to .0001" are given for all pressure angles.

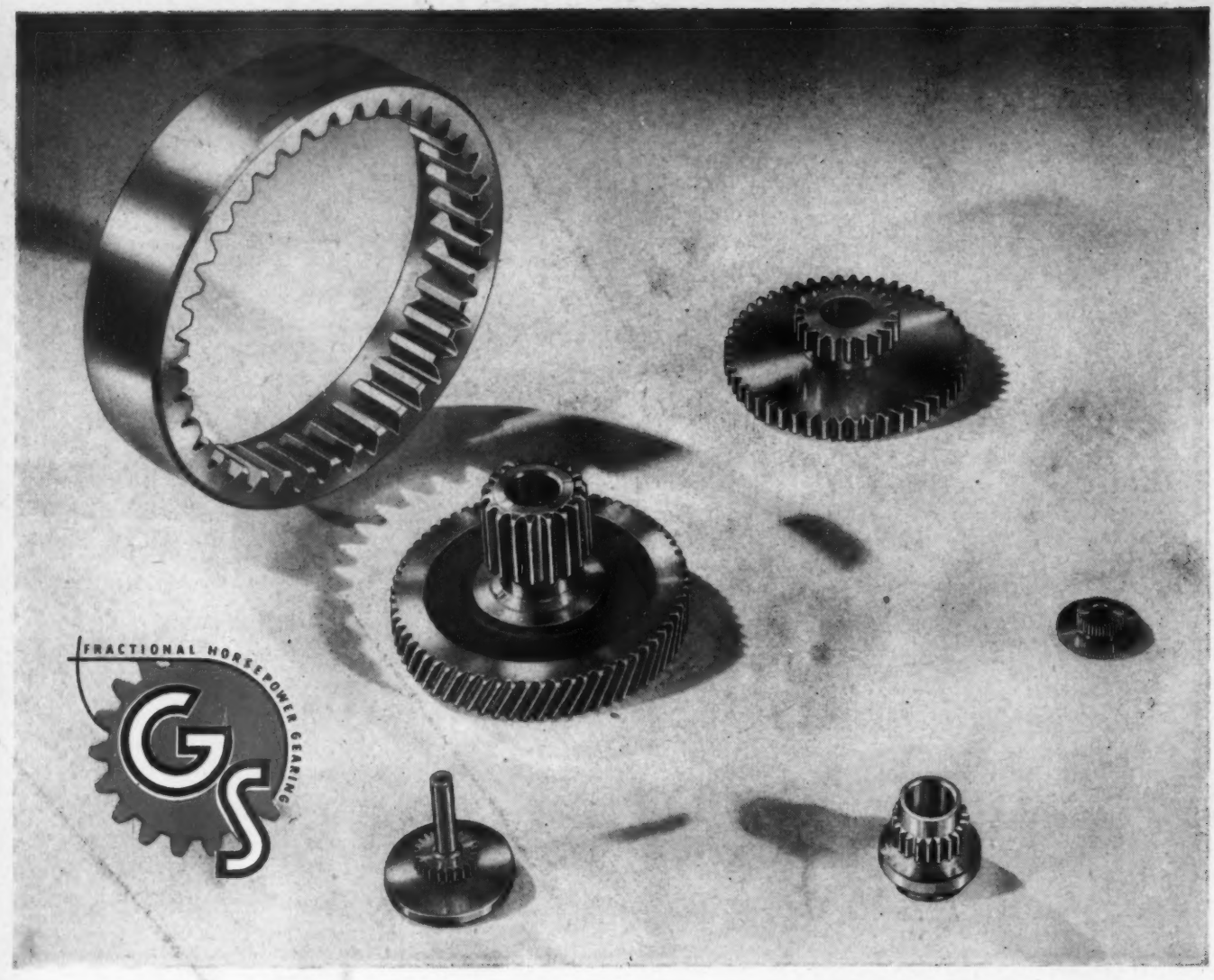
ULTIMATE ACCURACY

Catalog No. 33 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring standard and special threads, splines, spur gears, helical gears and worms. Send for Catalog 33.

MEMBER OF ACMA

Van Keuren

27th YEAR



GO TO A *Specialist* WHEN YOU WANT THE BEST

That's usually good advice whether you want gherkins, or guns or . . Gears! Here at G.S. we've been specializing for more than a quarter century on making Fractional Horsepower Gears *exclusively*. Methods, and manpower, and machinery . . all have been raised to the highest possible efficiency . . all concentrate upon producing gears in quantity to a degree of *uniform* excellence unapproached, we believe, in the history of Small Gear Manufacture. For your own best interests, submit your fractional horsepower gear problems to our competent staff. Write today for the new G.S. catalog bulletin.

GEAR Specialties

Spurs • Spirals • Helicals • Bevels • Internals • Worm Gearing • Racks • Thread Grinding

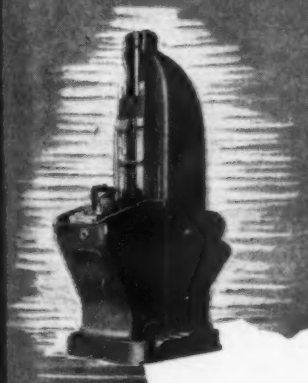
2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS

MEMBER OF AGMA

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

Similar parts can in many cases be handled on one machine using fixture adapters to accommodate the variations in size or shape. It is not necessary to purchase separate machines for each piece.

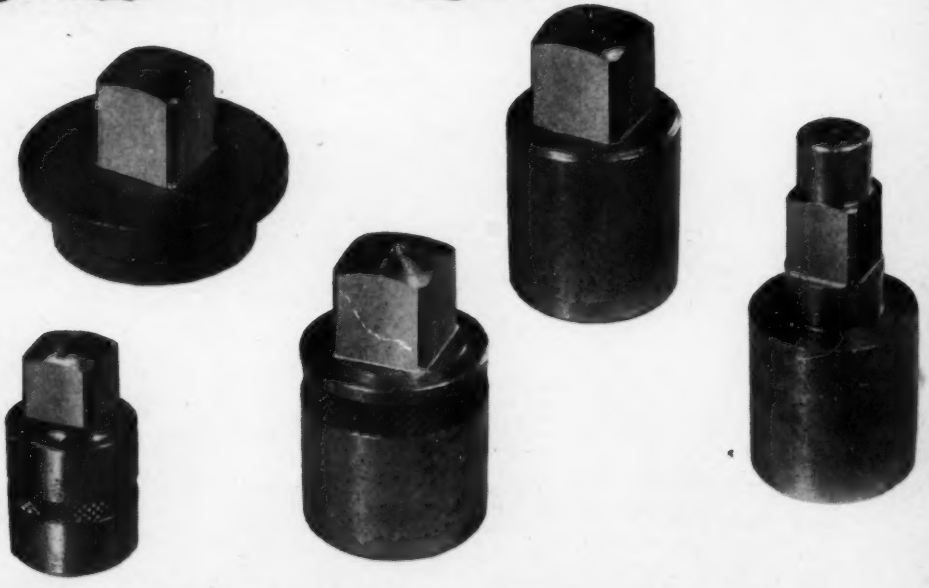
Surface Broaching OF SIMILAR PARTS



Throughout the metal working field there are many parts that can be surface broached at remarkable savings over the costs of the present machining method. The aircraft, automotive, small tool, appliance and even sporting goods manufacturers have all found ways of making parts faster, cheaper and to finer tolerances through the use of Footburt Surface Broaching Machines. We will be glad to work with you on the application of surface broaching.

THE FOOTE-BURT COMPANY · Cleveland 8, Ohio · Detroit Office: General Motors Building

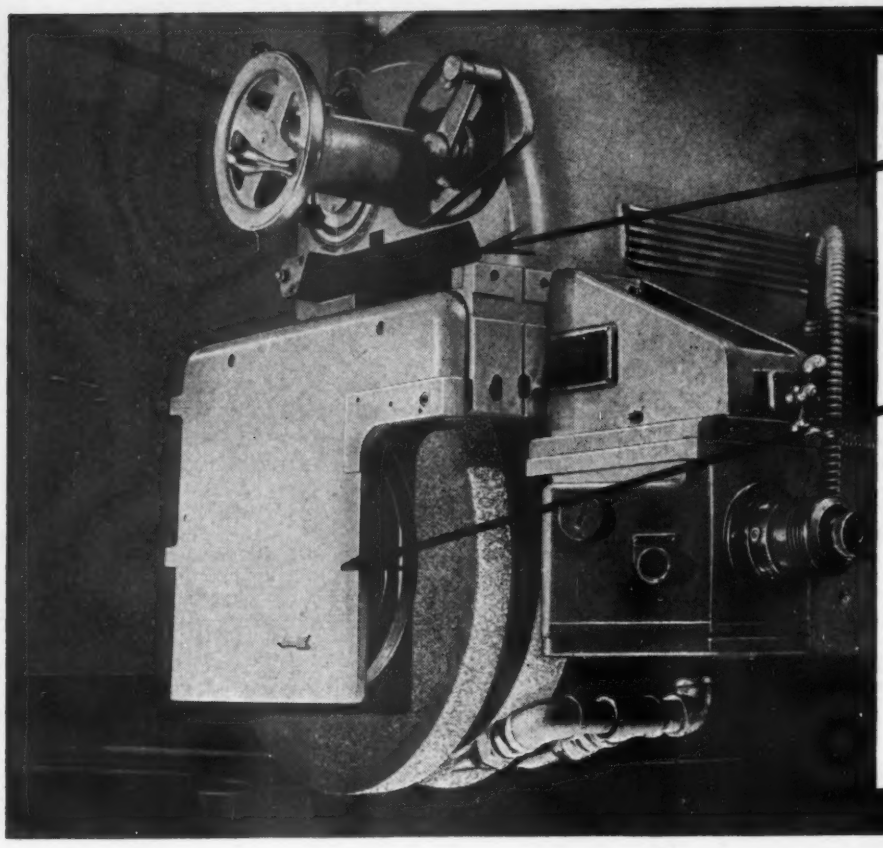
The squaring of the ends of the various socket wrench parts illustrated was done with one machine using adjustable broach and fixture adapters.



Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

Only Thompson provides all these cost-saving developments!



1. Flame Hardened Bearings

(Exclusive Thompson feature.) Wheel head slide ways are flame hardened and precision ground for *permanent* accuracy.

2. Pressure Lubricated Spindles

(Exclusive Thompson feature.) Direct-powered wheel-head spindle of heat-treated alloy steel in silver-lined bearings is permanently vibration-free. Positive automatic *pressure lubrication* is provided by pump inter-locked with spindle motor.

Type C Grinder (36" x 36" x 96") shown grinding ways of machine bed. Both flat and "vee" type wheels are mounted on wheel head spindle.

3. Automatic Wheel Truing (pioneered by Thompson). The stationary truer provides instant availability of the truing tool. All wheel head slides are now equipped with hydraulic wheel truing feeds. It is not necessary to disturb the work piece in order to true the wheel.

4. Angular Wheel Truing (pioneered by Thompson). Attachment equipped with two truing tools, both sides of the included angle are trued simultaneously. Universal motor with speed variation 5" to 40" p.m. controlled by governor insures accurate, smooth truing for fine finish and precision on work piece.

5. Automatic Down Feed (exclusive Thompson feature). Feed cycle of .00025" to .004" is available at each table reversal for plunge cutting or at each wheel head feed reversal. Feed mechanism has automatic trip—can be pre-set for size control from elevating hand wheel graduations, duplicating accuracy to .0002".

6. Automatic Sparkout Control (exclusive Thompson feature). Allows table and wheel head to continue finishing cuts after automatic down feed device has reached pre-determined size. At fixed time after work size is reached, table rapid traverses to loading position and stops automatically. Usually furnished in conjunction with automatic down feed. This device maintains accurate duplication of dimensions and makes possible battery installations by releasing operator for loading other machines.

7. Anti-Friction Elevating Unit (exclusive Thompson feature). Friction between screw and nut is reduced 70% to permit accurate feeding to .0001". Also minimizes effort of moving saddle assembly when making new setups without power elevation. Permits inexperienced operators to finish work by following handwheel graduations.

8. Double-Length Bed (exclusive Thompson feature). Massive *double-length* solid-cast beds are provided with heavy cross-section and numerous ribs at vital points to provide absolute rigidity for table.

• • •

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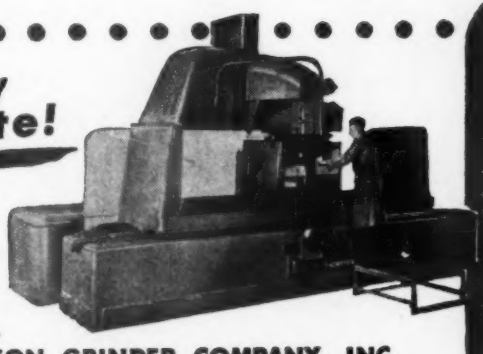
THE THOMPSON GRINDER CO. INC.

Before you buy investigate!



Thompson SURFACE Grinders

Address Dept.
THE THOMPSON GRINDER COMPANY, INC.
SPRINGFIELD, OHIO

Bliss' Stamping Grounds

FROM PILOT CABIN TO WING TIPS, power presses are helping to chart a new course in aircraft mass-production. And when you say "mass-production," you're on "Bliss' Stamping Grounds."

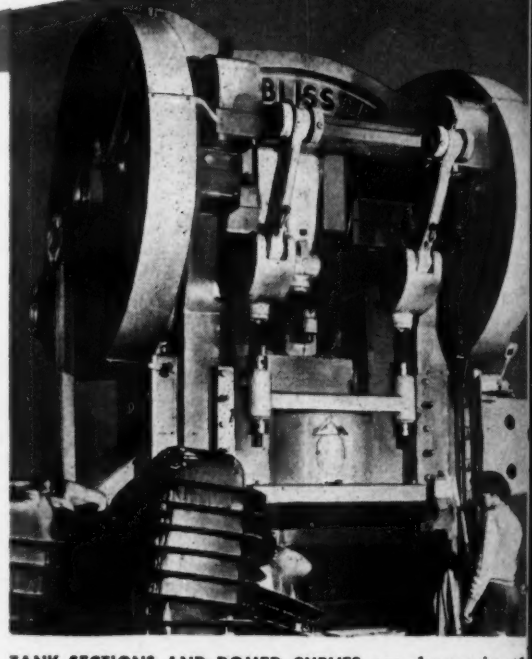
It may surprise you to learn that presses shape as much as 75% of the airframe weight of today's amphibious private plane. The bulkhead, wing ribs and hull skin, for example, are pressed metal. Then there's the side of the hull, cabins and cabin sides, air foils, floats, pilot seat and the instrument panel...all products of the stamping press.

Bliss presses are very much "on the beam" in taking a plane through the complete stamping cycle, for Bliss makes every type and size press required to form, blank or draw all the diversified sizes and shapes for aviation's newer miracles. Bliss engineering pioneered the development of automatic high production presses for progressive and compound dies to speed quantity, low-cost manufacture of precision parts and control instruments.

At Bliss, the merging of press-building "know-how" and advanced engineering techniques has kept pace with pressed metal needs for 90 years. It's yours to put to work.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

WORKS AT: Brooklyn; Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Derby, England; St. Ouen sur Seine, France • SALES OFFICES: Detroit; Brooklyn; Cleveland, Dayton, Toledo, Ohio; Lansing, Mich.; Chicago; Philadelphia; Rochester; New Haven; Boston; Toronto.

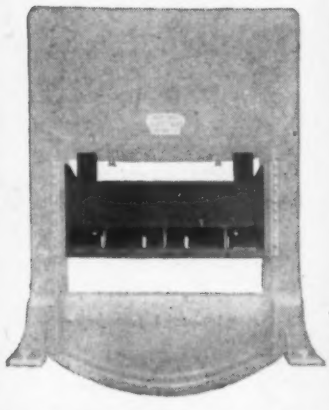


TANK SECTIONS AND DOMED CURVES are drawn in th Bliss High Production Toggle Press at Douglas Ai craft's Long Beach Plant. Designed for operating a maintenance simplicity, the press features rigid, ti rod frame construction and timed bottom dwe

STAY AHEAD WITH *Bliss*

For Mechanical and Hydraulic Presses
Rolling Mills
Can and Container Machinery

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY



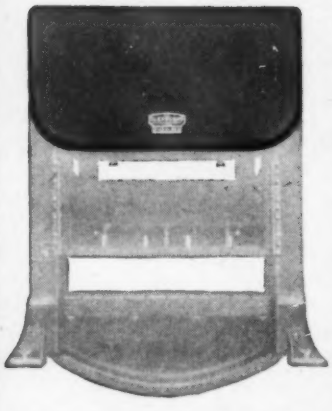
Modern Cleveland Two Point Presses have two connections — one at each side of the slide.

Modern 1 2 TWO POINT Presses

Except for the number of connections for the slide, all Modern Cleveland Presses are similar in design and construction.

The above illustration shows a Cleveland Two Point Press which is arranged with two connections, (as shown by the small engraving to the left) and this particular Press has a stroke of 10"; 8" adjustment; 30" shut height; 46" x 120" bed area; 350 tons capacity and operates at 15 strokes per minute.

Other Presses of this type are the Four Point, (having four connections) and the Single Point (having one connection) and each type can be furnished in a wide range of sizes and capacities to suit particular requirements.



The gears, flywheel and drive unit are located in the box type crown—with all gears running in oil.

The CLEVELAND PUNCH & SHEAR WORKS COMPANY. . Cleveland 14, Ohio

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Use Aluminum Rivets made of Alcoa Alloy 56S in assembling Magnesium Products

Did you know that magnesium alloy products are assembled with aluminum rivets?—usually Alcoa Aluminum Alloy 56S. They do a good job under permissible conditions of stress and exposure.

Alcoa supplies rivets in any style you want, of course. And instructions for preparing parts for assembly, methods of driving and finishing, may be obtained through Alcoa.

DO YOU HAVE THIS BOOK?

"Designing with Magnesium" contains a wealth of data useful to designers and fabricators. It will help you employ weight-saving magnesium to best advantage.

For a free copy, call the nearby Alcoa office. Or write Aluminum Company of America, Sales Agent for American Magnesium products, 1709 Gulf Bldg., Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

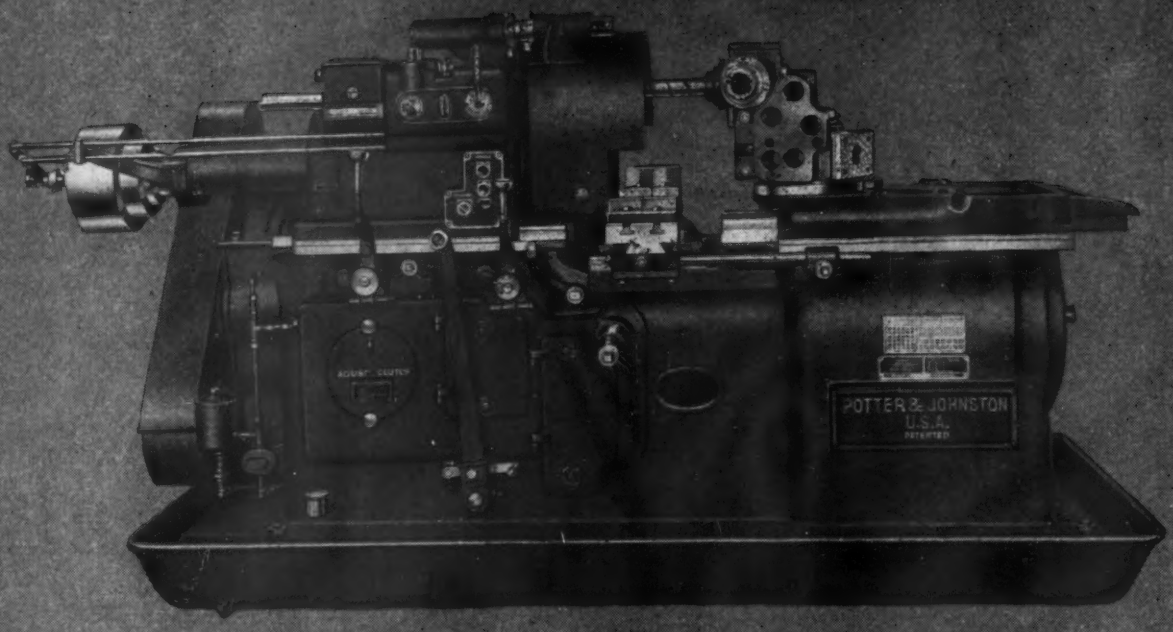
REG. U. S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF

ALUMINUM COMPANY OF AMERICA

The P&J 4 D MANUFACTURING AUTOMATIC CHUCKING AND TURNING MACHINE



. . . . . DUPLICATION OF SMALL PARTS CAN BE HANDLED AT LOWER COST...ON THIS MODERN MACHINE

Quality of finished product, increased output and an appreciable reduction in overall production costs as compared with hand machines makes the Model 4D P&J machine an invaluable means for machining a wide variety of small duplicate parts. It provides versatility in tooling and with its 15 changes of speed, arranged in five sets of three automatic changes with feeds varying directly with the spindle speed, its operation can be readily and effectively adapted to the specific job it is set up to handle.

Other features of this rugged, compact machine include: a Timken mounted spindle high carbon forged steel; headstock gearing of chrome nickel steel, heat treated and running in a bath of oil; all shafts of alloy steel, heat treated and mounted on ball bearings; speeds from 24 to 335 RPM; 27 feeds in geometric progression; cross slide mechanism fully enclosed and operating in an oil bath; rigidly constructed turret slide provided with hardened and ground inserts to form bearing on base ways.

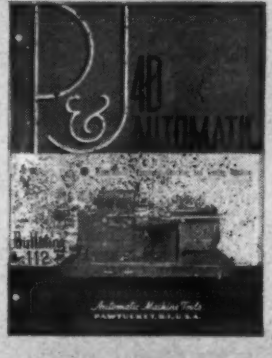
●

Specifications

Swing over bed . . . 21" dia.
Swing over cross slide . . . 9¾" dia.
Cross slide travel . . . 3¼" each way
Number of turret faces . . . 5 std., 4 and 6 special
Hole in turret . . . 2" dia.
Turret feed . . . 5½".

●

Complete details on this machine are contained in Bulletin 112, available promptly on request.



POTTER & JOHNSTON MACHINE CO., PAWTUCKET, R. I.

ANNOUNCING THE NEW

No. 112-M

HYDRAULIC INTERNAL GRINDER

FOR LONG WORK

The *new* No. 112-M Bryant Internal Grinder is designed to precision grind bores up to 9 inches in depth in extra-long, hard-to-chuck parts. Work, such as a machine tool spindle, a long arbor, or a shaft, is supported rigidly, either in a hollow work spindle and steady rest, or by a special fixture that allows the work to run in its own bearings. And, the 112-M offers flexibility that is particularly valuable where production schedules require frequent set-up changes. Adequate longitudinal and swiveling adjustments are provided for grinding tapers up to 30 degrees and reverse tapers up to 10 degrees. A hydraulic retracting mechanism for the wheel slide facilitates loading and gaging long parts, while conveniently located controls simplify operation and set-up. Complete details, capacities and dimensions are contained in the new catalog sheet and will be sent on request — or better still, if you have any work or problems that involve internal grinding—

Send for the man from Bryant.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

UNIFORM WELDS... *Automatically!*

with G.E.'s *Current Regulator*

The operator of this traveling resistance-welder at the Pullman Standard Car Manufacturing Co., gets consistent welds automatically

Equipped with a G-E electronic current regulator and synchronous control, this resistance welding machine travels the length of the Pullman car producing uniform welds automatically. Each of these welds is of equal strength because the current regulator ***automatically compensates for varying line voltage and secondary circuit impedance.***

In welding these cars, two spot welds are made at a time, the spacing between the two varying in accordance with the dimensions of the parts and the strength specifications. As the spacing varies, the length of the secondary circuit changes, and in turn the current is changed.

Where formerly this shift meant frequent readjustments by the operator, guided by an extensive table of machine settings, now just one of two settings is needed, depending on whether the machine is welding Cor-Ten or stainless steel; the current regulator does the rest.

This regulator holds current within plus or minus 2 per-cent of normal, whereas, the unregulated current might vary as much as plus or minus 20 per-cent.

Even when space is uniform, current is affected by varying amount of magnetic material in current loop.

IMPROVES QUALITY

In this, and other applications such as welding propeller blades, metal barrels, etc., this regulator provides uniform quality welds when more or less metal is introduced in the welder throat.

FLEXIBLE OPERATION

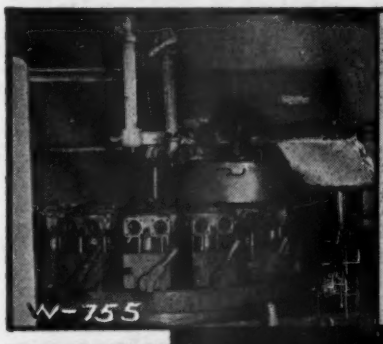
The same settings can be used when operating a press-type spot welder, a gun welder connected to the same transformer, or when welding magnetic materials with a press-or gun-type welder.

—The current regulator is specially designed for use with G-E electronic resistance welding controls which include heat control by the phase-shift method.

For additional information ask our nearest local office for Bulletin GEA-4220. ***Apparatus Department, General Electric Company, Schenectady 5, N.Y.***

GENERAL ELECTRIC

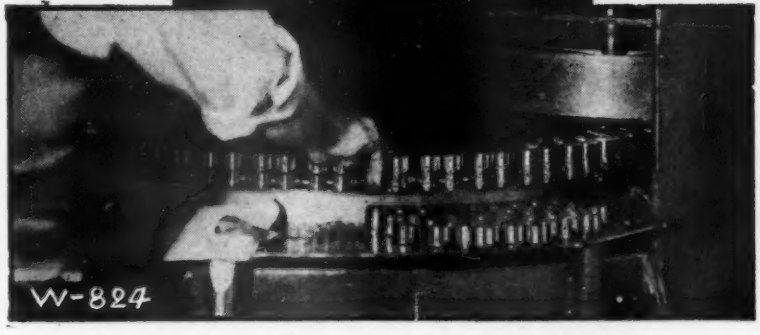
FOR CLOSE LIMITS-*Blanchardize*



The Blanchard No. 18 Surface Grinder is used to rough and finish-grind these oil burner parts, and .012″ of stock is ground off one side to limits of +.0003″ −.0001″. (48 per hour)

Eighteen of these cast iron ball bearing spacers, with eighteen smaller spacers inside of them are ground to limits of .0002″ after removing .025″ of stock. (144 surfaces per hour)

This is an excellent example of accurate surface grinding of pump body parts on a No. 18 Blanchard, Surface Grinder. The material is high strength forged steel and .004″ of stock is removed from each side to limits of ±.0003″. (80 surfaces per hour)



These heat-treated steel trunnion bearings are ground on a No. 16-A2 Blanchard Surface Grinder. They are ground to limits of ±.0005″ after removing .005″ to .015″ of stock. (2315 per hour)

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

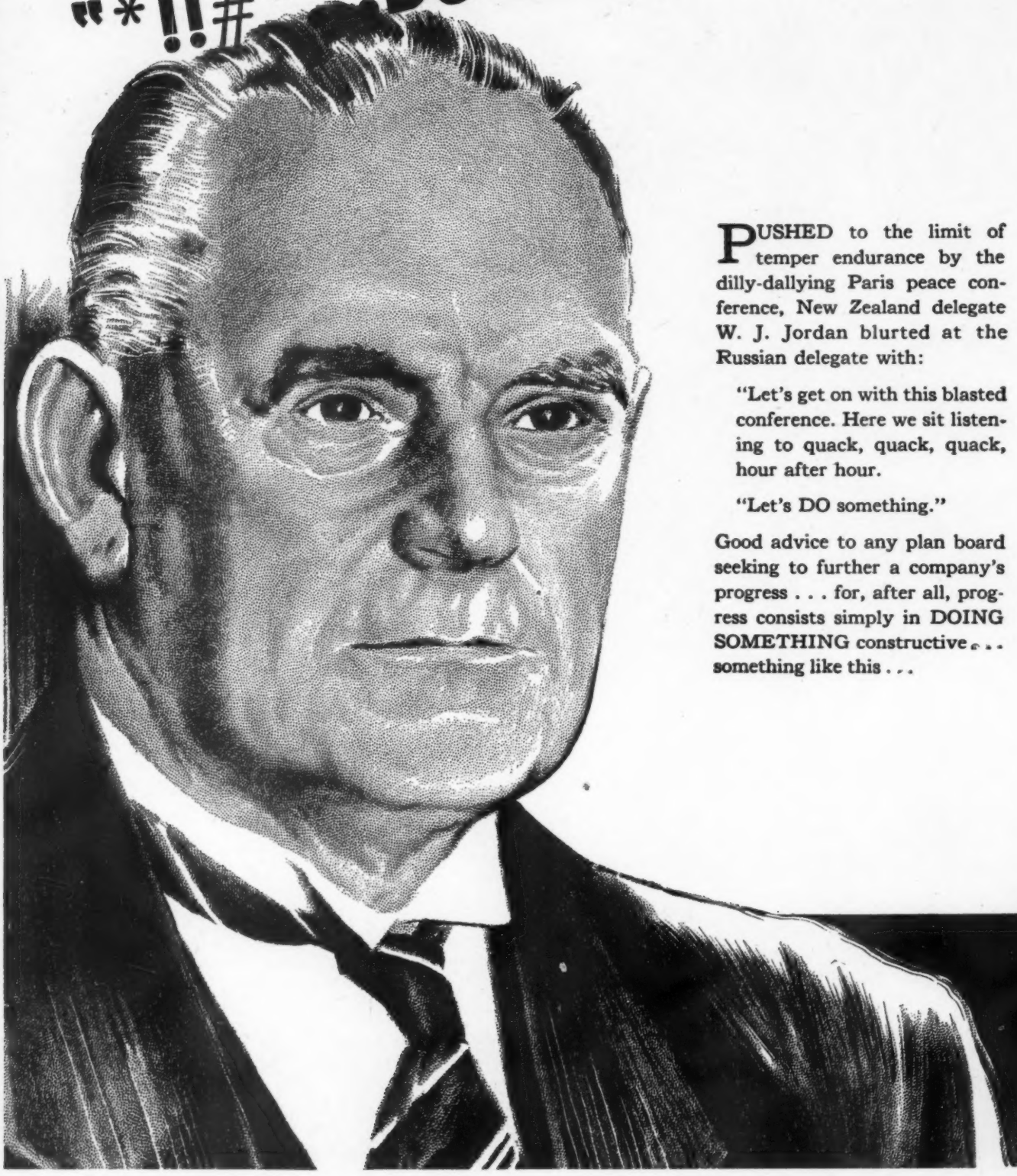
BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

then he said to himself:

"**!!#* . . DO SOMETHING!"



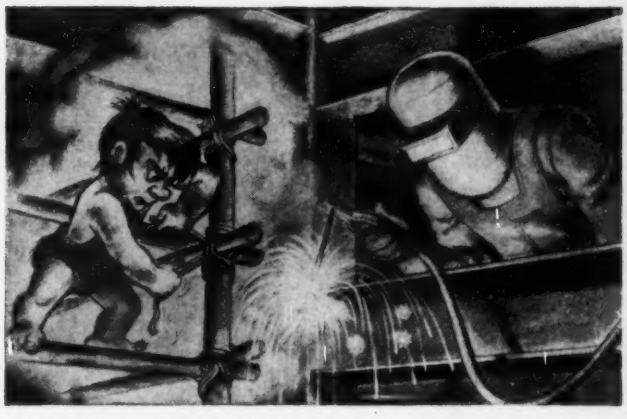
PUSHED to the limit of temper endurance by the dilly-dallying Paris peace conference, New Zealand delegate W. J. Jordan blurted at the Russian delegate with:

> "Let's get on with this blasted conference. Here we sit listening to quack, quack, quack, hour after hour.
>
> "Let's DO something."

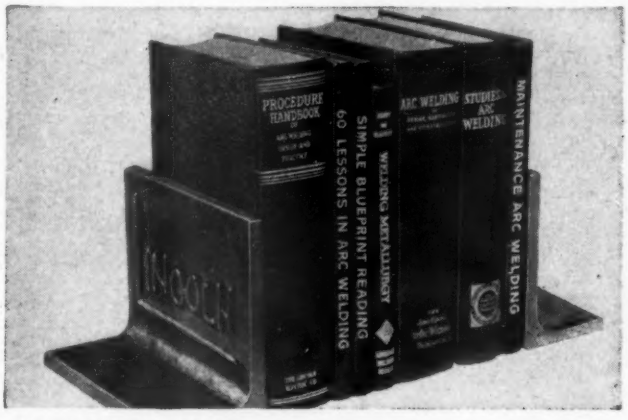
Good advice to any plan board seeking to further a company's progress . . . for, after all, progress consists simply in DOING SOMETHING constructive . . . something like this . . .

Look, Mr. Jordan, **how Lincoln is helping engineers, production men and executives DO SOMETHING constructive with arc welding:**

CUT WELDING COSTS. To help supervisors and foremen use arc welding more economically, Lincoln publishes a series of procedure sheets and will send these on request. Procedure bulletins on manual and automatic welding are available to engineers and supervisors. Write us, stating your particular application.



SOLVE DESIGN PROBLEMS. The Lincoln sound-color movie, "Design for Arc Welded Structures" depicts the progress of construction from cave man days . . . is packed with ideas for design and lower costs. Full details in Bul. 719. "The Prevention and Control of Distortion in Arc Welding", explains the causes and cures of distortion. Ask for Bul. 709.



LEARN FROM OTHERS. The Lincoln library of arc welding knowledge includes the world's leading books on all phases of the subject. New 8th Edition Procedure Handbook contains 1312 pages of latest facts gathered by experts the world over. Price, $1.50 (postpaid in U.S.A.). Write for free Bul. 713 and Bul. JFLF 128 on Lincoln books.

ASK FOR ADVICE. Mr. R. H. Davies, Consulting Engineer of The Lincoln Electric Company, will come to your plant for three days or longer for an advanced course in welding engineering and to discuss welded design as applied to your problems. Write to R. H. Davies for details. The cost for this service is small.

THE LINCOLN ELECTRIC COMPANY • Dept. 295 • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

12-STATION SNYDER SPECIAL Mills, Saws, Drills, Counterbores, Reams, Burrs and Taps Auto Connecting Rods

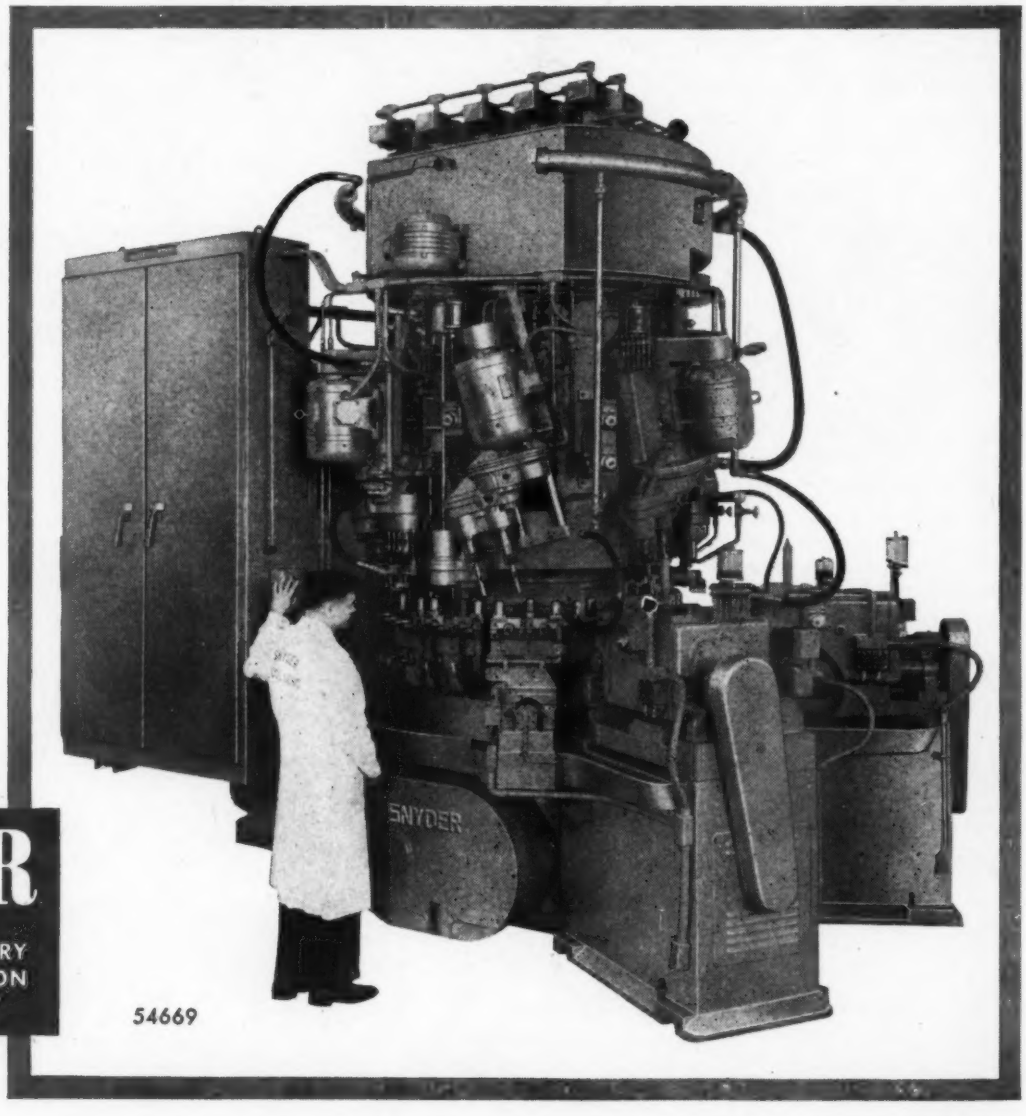
This special automatic was designed and built by Snyder for mass-production machining of drop-forged steel connecting rods. Operating at 80% of rated efficiency, the 12-station special delivers an hourly production of 266 connecting rods machined complete except for bearing cap joint faces and crank and wrist pin holes.

At the twelve vertical and horizontal stations, a total of sixteen operations is performed, including drilling, milling, sawing, burring, counterboring, countersinking, tapping and reaming. Parts are loaded two at a time and are clamped in fixtures by a power-driven wrench, then positioned for machining by the power-driven Geneva index table. The entire operating cycle is automatic.

Tool set-up and maintenance is simple and rapid. High speed steel tools employed throughout are provided with arbors and quick-change adjustable tool holders. Individual unit cycle control buttons permit positioning and adjustment. Rigid column construction, correct tool feeds and speeds, and proper coolant supply extend tool life and assure work of specified precision and finish.

Standard and special machining units have individual motors and drive through a change-gear box and V-belts. They are fed hydraulically except tapping head, which is moved to and from the tapping position hydraulically, but is lead-screw fed for work stroke. Base and column are constructed of fine-grained cast iron, thoroughly normalized and ribbed for strength and rigidity. Units are easily accessible for greasing and oiling.

Some phase of your production process may be similarly improved and speeded by the application of special machinery. Check with us for possible economies. *Snyder Tool and Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*



21 Years of Successful Cooperation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

THE CINCINNATI BICKFORD EASY CONTROL

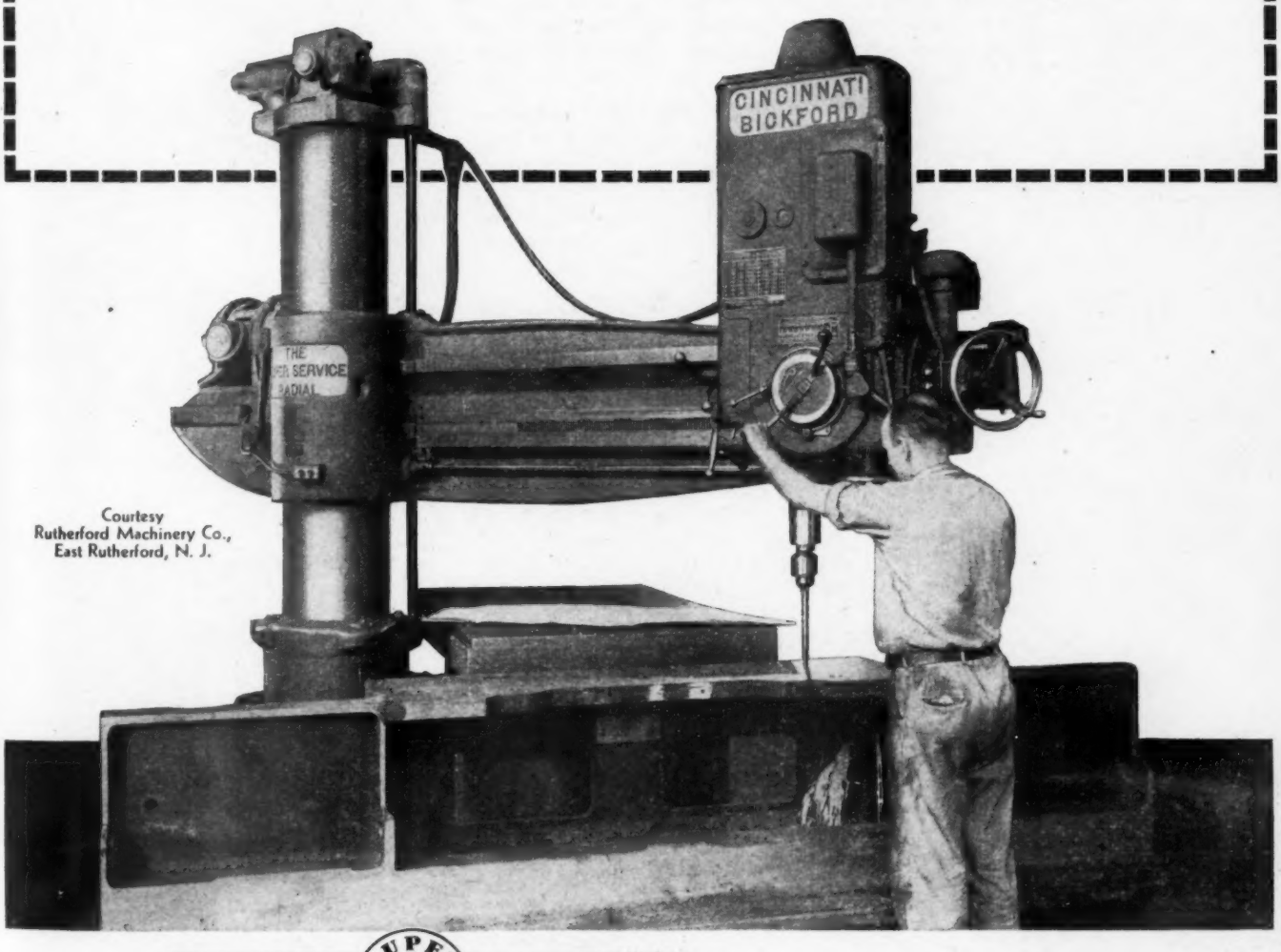
Saved Time here—

The Rutherford Machinery Company, East Rutherford, New Jersey, says: "Our new Cincinnati Bickford Super Service Radial Drill is easy to handle, and very accurate in drilling, reaming, boring and tapping—has increased both our production and accuracy."

Drilling costs were reduced 25% in drilling, reaming and counterboring a total of sixty holes in this 3200-lb. casting.

Write for detailed Bulletin R-24A

See our condensed Catalog in Sweet's File.



Courtesy
Rutherford Machinery Co.,
East Rutherford, N. J.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.

CrysCoat

the NEW, low-cost Oakite process that prepares surfaces for perfect paint adhesion

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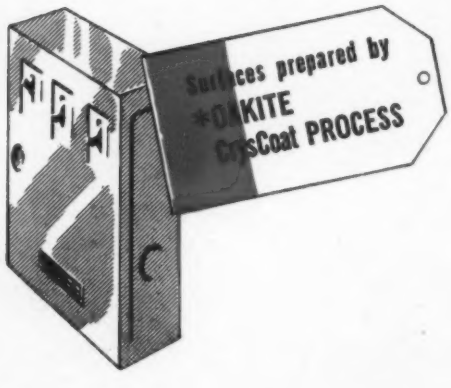
* for maximum paint adhesion and protection against rust and corrosion.



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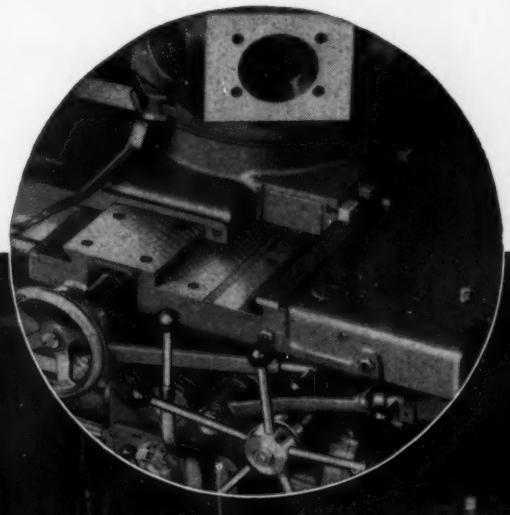

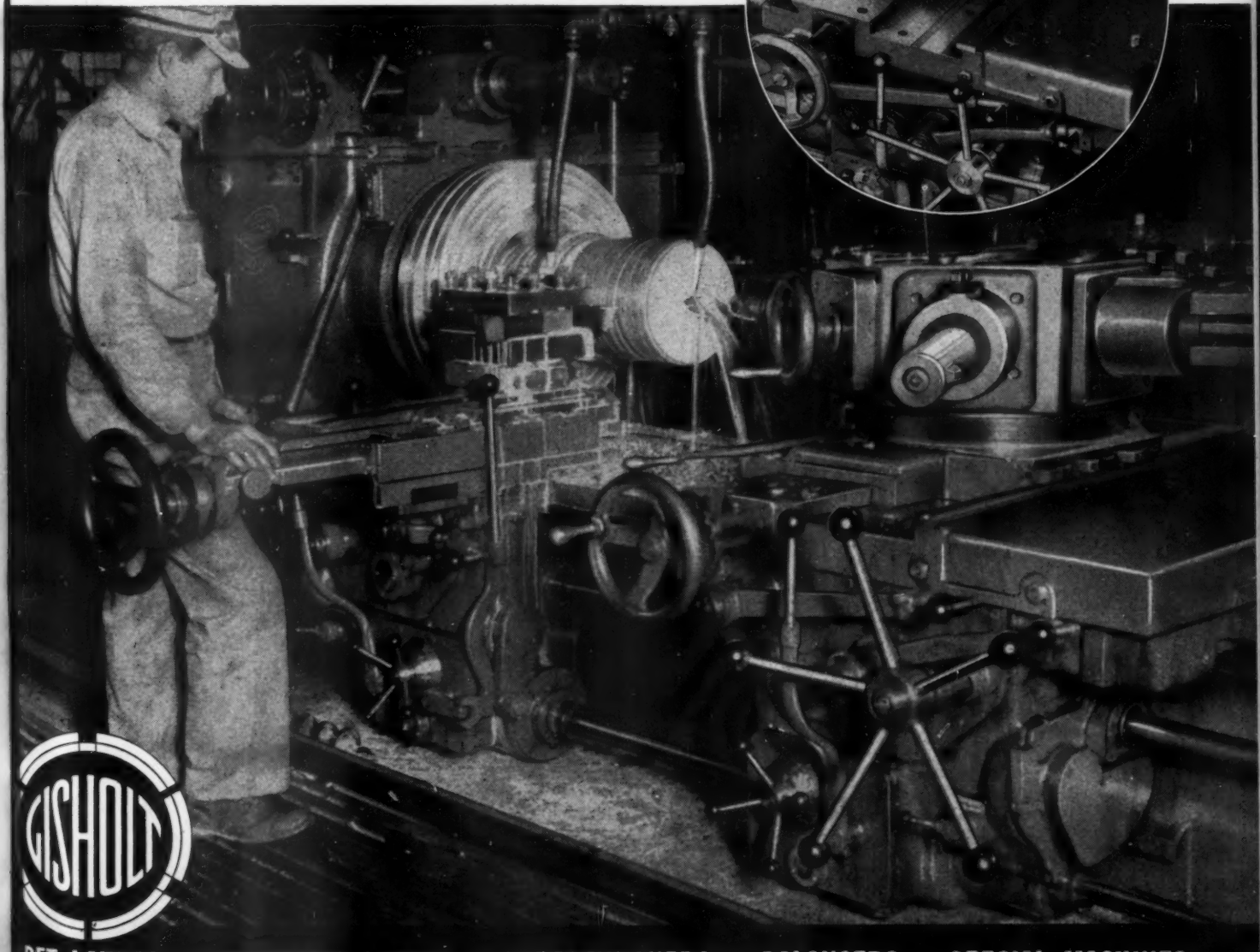

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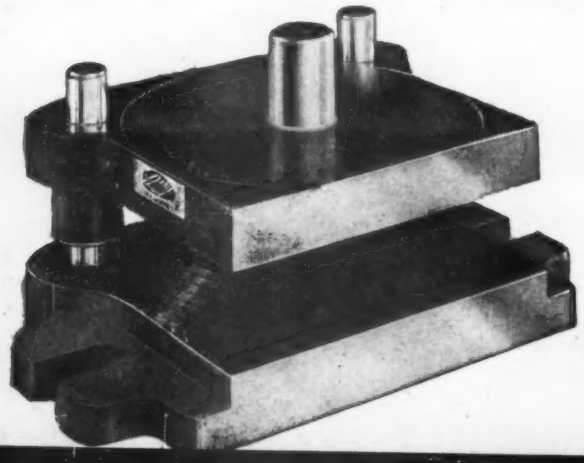

DIE MAKERS' SUPPLIE

DANLY DIE SETS

Welded Steel Fabricati

American Machinist's Spot NEWS OF METALWORKING

Hot-rolled and cold-rolled sheets at $100 a ton over the market price have been offered by brokers to large steel users. In certain cases the steel is owned by fabricators who have more tonnage than they immediately can use, in other instances the steel is in jobbers' hands.

Automobile buyers will be given 18 to 24 months to pay for new cars if government regulation is relaxed in accordance with request of automobile finance companies. Under existing restrictions weekly take-home pay is not enough to take care of $70-a-month payments required for the cheapest cars (practical ratio is monthly payment equal to purchaser's weekly pay check).

Operation of tiny plants employing a few hundred men yields a manufacturing cost only 80% of that in big plants making the same items, according to record of one of the nation's important manufacturers. Reduced managerial expense, fewer plant services essential to a big shop and more efficient individual workmanship account for the difference in costs.

British automobile production is low because sheet steel is scarce and other materials shortages exist. Housing has higher sheet steel priority than automobiles, and non-British steel sources promise little help in '47. Output this year will be 225,000 vehicles, compared with 500,000 prewar and potential capacity today of 750,000. Retail prices are double the 1939 level.

> Of Japan's war-end inventory of 775,000 machine tools, 600,000 are to be removed. Permanent ceiling of 175,000 units has been fixed. All machine tool building capacity above that needed to make 10,000 units a year is to be dismantled. Three largest tungsten carbide tool plants, six largest cutting tool shops and all facilities for making bearings are to be eliminated, making the country dependent on imports.

Man-years of work equal to a year's full production by Chrysler Corp. have been lost by strikes in the automobile industry during the past year.

Machine tool builders are now listing surplus machines of their own makes which they think should be kept in reserve by the services for future emergency. Efforts are now being made to locate these machines. This is part of program sponsored by Army and Navy Munitions Board, upon advice of machine tool industry, to preserve machine tools valuable to nation's defense (and stop current scrapping of them). Many of these machines are useful only for munitions-making purposes.

AFL and CIO are farther apart than ever, despite Murray's public statements supporting Lewis in recent coal strike. Fact is that AFL has been in ascendancy since war's end, membership being at an all-time high of 7,151,800, whereas CIO membership has declined to about 6,000,000. United Steelworkers' wage demands to be made soon will provide clue to CIO wage program.

WAA is having trouble selling surplus war plants because big companies are reluctant even to ask for them. They think that Justice Department will turn down their requests. Many plants are unsuitable for civilian goods production or are badly located, and new plants would be cheaper.

Inventory control still is major problem. One big company has so much money tied up in inventories that it had to borrow for first time in its history. Another manufacturer doing business of $3,000,000 a month has 70 people in its purchasing department, trying to keep stocks balanced.

Not much reduction in cost of making automobiles can be expected until a re-engineering job can be done by car makers. At current labor rates and production per man, savings of only 2% can be anticipated in near future.

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ESTABLISHED 1877

American Machinist

BURNHAM FINNEY, Editor

To Protect the Public's Rights

John L. Lewis' recent defiance of law and order should not have shocked the country. His decision to suspend coal mining though it invited economic disaster and widespread suffering was characteristic of the "public-be-damned" policy which not only he, but other union leaders have been following for some time.

By his action Mr. Lewis made himself the spearhead in a union drive toward industrial anarchy. To be sure, "industrial anarchy" is a strong term to use, but what other term fitted the situation?

The situation is this: men go on strike whenever they feel the impulse, many times over the most trivial grievances. Strikes often are pulled by small militant minorities, the shutdowns thereby affecting industries and people far removed from the actual strike scenes. Mass picketing is freely indulged in, though it constitutes intimidation of workers who may want to continue at their jobs.

Unions have not hesitated to isolate entire communities and attempt to paralyze all industrial operations. Witness the power utility strike in Pittsburgh, the general strike in Oakland, Cal., the tug strike in New York City.

Mr. Lewis' state of mind and actions were merely symptomatic of the "public-be-damned" virus which has been running through the veins of union officials. The only difference is that Mr. Lewis has had the disease in a more virulent form than others, and coal happened to affect almost every man, woman and child in the United States.

The trouble is that our laws and the government's pro-labor policy up to now have made it extremely easy and safe for a union leader to call a strike. There is little if any risk involved. In many states strikers have been able to draw unemployment compensation. If union officials get caught in a bad position, sympathetic government agencies help extricate them.

Worst of all, union leaders have become so powerful that they consider themselves above the law. Look at Mr. Lewis bellowing defiance in the face of Judge Goldsborough. Look at Michael Quill's repeated threats to close down New York City's transportation system.

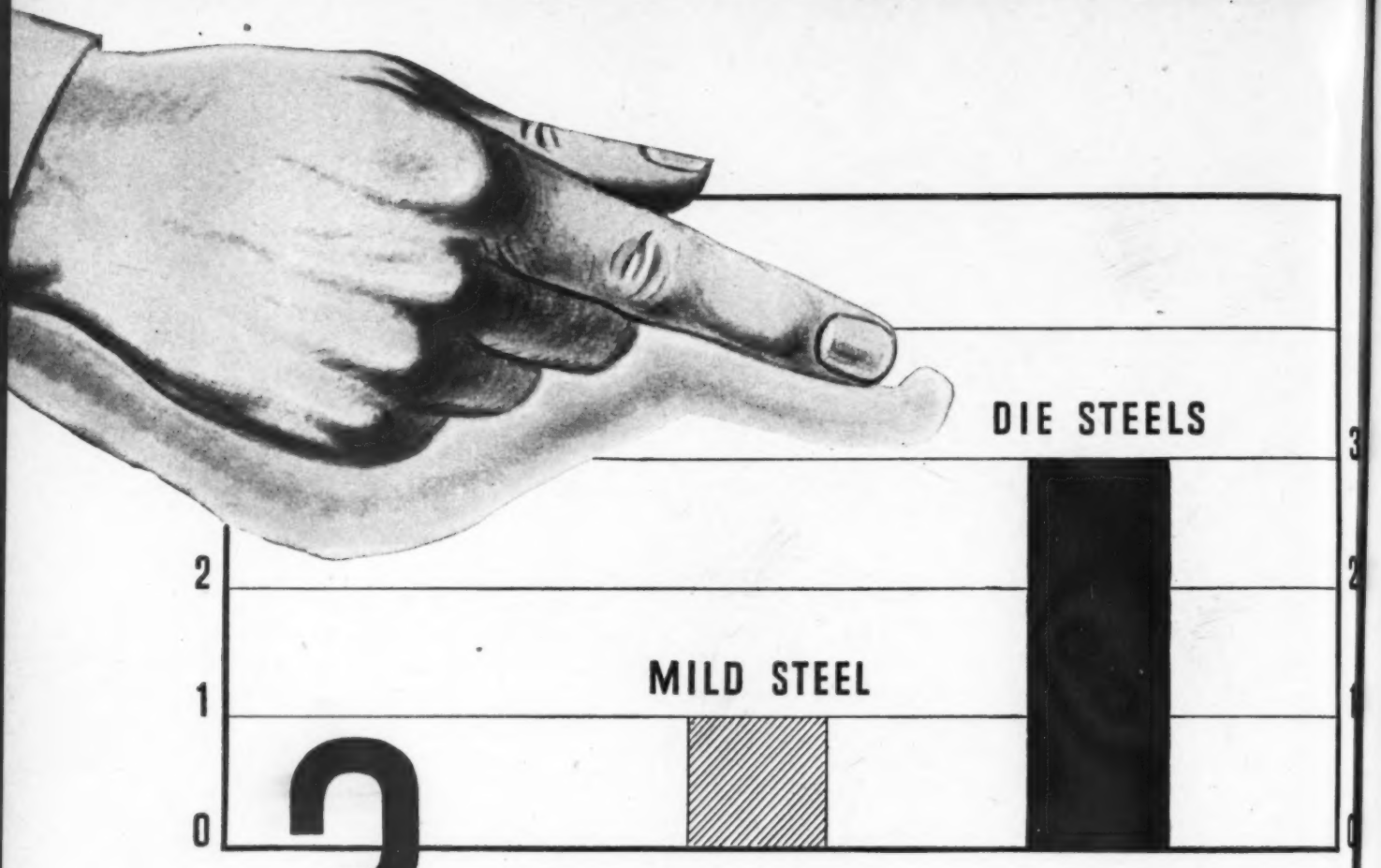
In this deplorable situation, there is only one clear-cut recourse. National legislation should be passed at the earliest moment to prevent further abuse of the public's rights.

The Wagner Act should be amended to give management a fair and equal chance in collective bargaining. Unions should be required to bargain, just as management is so obligated. Employers should have more latitude in discussing problems with employees. They should have the right, as well as unions, to petition for elections when a union threatens to strike for recognition.

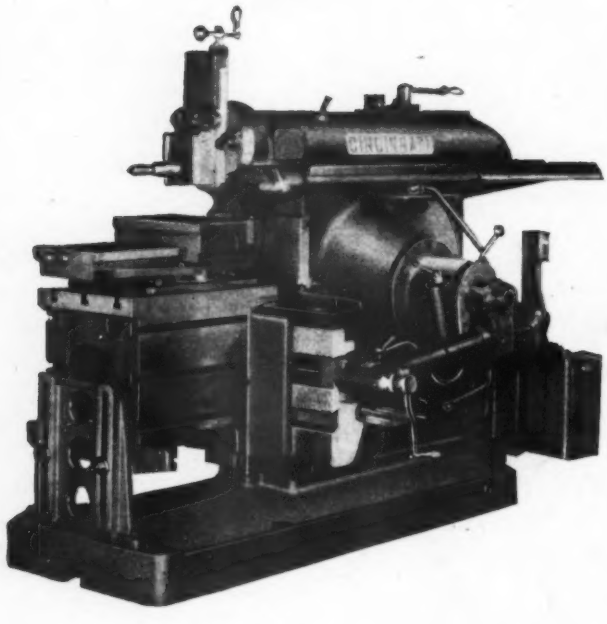
More than that, legislation should be enacted making legal the suing of unions for breach of contract, banning secondary boycotts, outlawing union welfare funds unless under joint management, and placing unions under anti-trust laws.

Congress should restore the balance of power between labor and management so that there are equal risks on both sides. Only then will we get away from the recent almost incredible spectacle of a great and powerful nation being strangled to death by one man who is not even an official of the United States government.

Burnham Finney



3 TIMES AS *TOUGH*..



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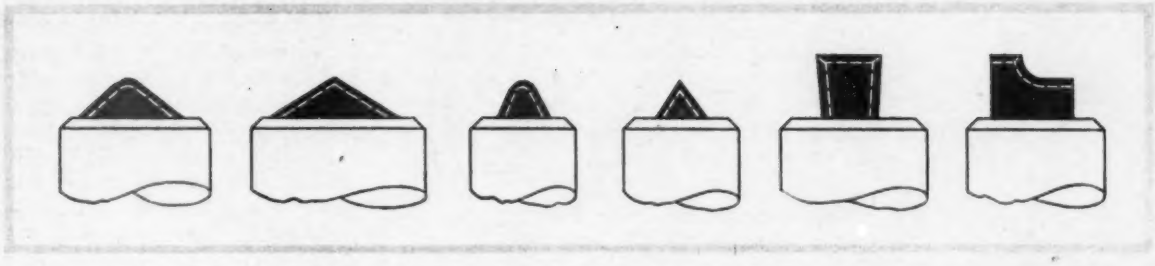
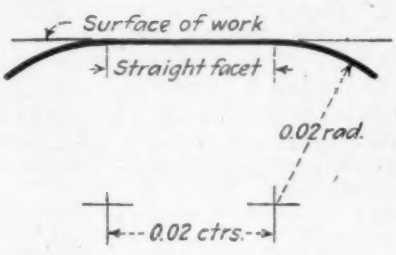




A typical selection of diamond-tipped tools for a plastics-machining setup might include V-shapes, with and without radius, cutoff edge and concave radius edge. Left, an improvement in surface finish is obtained if two facets are blended by a small radius of, say, 0.020 in. Here the straight facet is 0.020 in. long and is parallel to the work axis

Diamonds Cut Plastics With Precision

Resistance to abrasion, low heat generation, and capacity to hold keen cutting edges on long runs make diamond tools effective and practical in machining plastics

DIAMOND TOOLS are being widely used in machining plastics where close tolerances and good finish of machined surfaces are required. Responsible in no small measure for this trend is the volume of industrial plastic parts requiring an accuracy not ordinarily obtained by molding. The highly abrasive character of many plastics and their fillers makes maintenance of keen cutting edges on steel tools difficult and expensive.

Where interchangeability of industrial plastic parts must be maintained over long runs, deterioration of cutting edges must be held to a minimum. Diamond tools provide this and at the same time hold setup time and cost to a low figure.

Plastics are affected by temperature and humidity to a much greater extent than are metals. Precision, therefore, is dependent on a satisfactory aging period, which can be considerably shorter than that required for metals. This problem does not exist with rods, tubes and sheet, as they are usually supplied from storage and have already undergone dimensional changes.

If a part is to be held to tolerances of, say, plus or minus 0.002 in., it should be left 24 hr. before machining. For the ultimate in accuracy, the aging period may take up to six weeks.

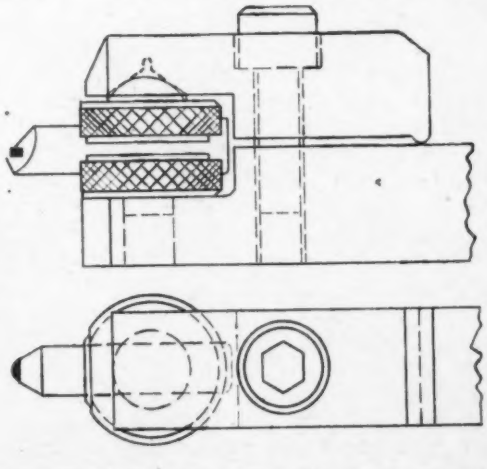
For practical purposes a good machined plastic surface will be smoother than the average molded surface. A fast, light buffing may be required in some cases. One leading molder supplies two grades of parts to his customers as:

(1) A regular production part to be used after delivery and held within limits of 0.002 in.

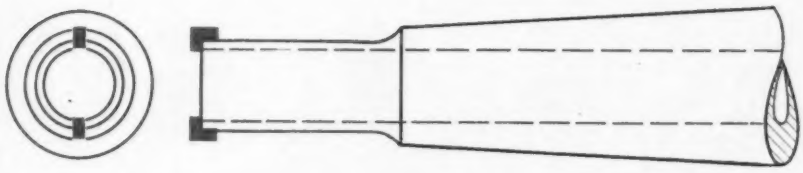
(2) Grade A quality to give a permanently accurate part. This type should be ordered farther in advance and allow for no blueprint changes.

Because of the low (almost negligible with properly designed tools) heat generation of diamond tools, distortion of plastics parts is held to a minimum or eliminated. This is particularly important when machining any of the thermoplastic materials. Precision machines with rigid toolholders and cross slides should always be used with diamond tools as they readily transmit machine inaccuracies.

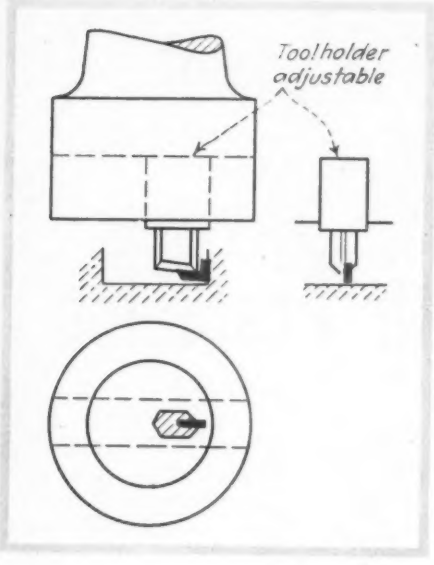
Machining, by removing a certain amount of surface resin, reduces the strength and resistance of plastic parts. Tests run by a leading molder indicates that while steel tools reduce strength by about 18%, diamond tools reduce it by only 8%. Tool marks, such as those made by a



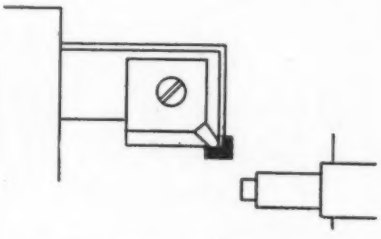
A useful holding device for diamond tools enables tool changes to be made without disturbing the setup, with minimum downtime



Tube drills for plastic tubing are equipped with diamond tips and show little wear over extremely long runs



Countersinking of plastic parts can be carried out at high speed with this diamond-tipped adjustable tool



Fountain-pen bodies of plastics may be readily turned with this diamond-tipped tool, devised especially for pipe-turning

DIAMONDS CUT PLASTICS continued

sharp V point, also contribute to strength loss.

Sides of the tool following the cutting edge should be as smooth as possible, as they control the required tool pressures. Diamond tools retain this smooth chip land over a long period and avoid any consequent heat generation.

Only one cutting edge of the diamond tool comes in contact with the work at any one time. Acute angles on the nose of the tool should be avoided because of the relatively low impact strength of diamonds.

Clearance angles of 5 to 10° are effective on turning tools, while boring-tool clearances depend on bore diameter and thickness of the diamond tip. Boring tools should be adjusted with the cutting edge just above center. Secondary clearances may also be used.

A point angle of 110-120° is good turning-tool practice, but angles as low as 80° may be safely used for turning shoulders and such similar operations. Angles as low as 55° have been used for thread cutting, but in general should be avoided.

The diamond tool should have a radius of from 0.005 to 0.020 in. Larger radii improve surface finish and make tool adjustment easier.

The optimum rake angle for diamond tools is 0 to 3°. A zero rake eases the problem of tool production and checking the tool in relation to the work. Tools with one cutting edge use a front adjusting angle of 45°, while multi-facet tools require from 18 to 30°.

Some time ago it was observed that good surface finish could be obtained with tool edges adjusted so that a small back adjusting angle is provided between the side cutting edge and the finished work surface. Angles as low as 1 to 2° were recommended. The side cutting edge gave a burnishing action and removed a part of the feed ridges.

Even better results were obtained with a blended facet, two facets being blended by a 0.020-in. radius. The straight side of the facet, 0.020 in. long, should be parallel to the work axis. Adjustment is made by optical means.

Multi-facet diamond tools are used the same way as single-facet tools. They provide alternative cutting edges should chipping or excessive wear be encountered. As many as seven facets may be used without difficulty.

Optimum surface finish depends on the form of the cutting edge its adjustment and speeds and feeds. Depth of cut has no influence on the surface finish unless the tool form hinders chip flow, and is usually in the range of 0.004 to 0.048 in.

Plastic materials can be machined at speeds to 4000-4200 fpm., but speeds should not be high enough to cause vibration. Hand feed is suitable; feeds may be between 0.0012 and 0.400 in., increasing with the size of the work. Where a high surface finish is required, feeds should be held in the vicinity of 0.002 in. According to theory, for a rounded tool edge of radius r the height of ridge h may be calculated from the Bauer formula, $h = \frac{s^2}{8r}$, where s is the feed per revolution in inches. This would indicate that by decreasing the feed one-half the surface finish should be four times as good.

Diamond tools are particularly suitable for cutting resilient materials such as synthetic rubbers and the more elastic plastics because of the relatively low cutting pressures generated. Thus no deformation of the work takes place during turning. Typewriter rollers are frequently reconditioned by finish-turning because of this lack of deformation.

An important application is the finishing of large calender rollers where unusually abrasive action is encountered. Sometimes rake angles of much more than 3° are used on this application and dust from the operation is held to a minimum.

Diamond parting tools about 0.050 wide are effective in turning of plastics and rubber disks. Here the diamond tool edge is bevelled and the surface finishing of the disks accomplishing in the parting operation.

Turning and Boring

Fountain-pen bodies are frequently diamond turned and bored and the hubs of laminated gears may be similarly finished. Thread-cutting and finishing of bearing surfaces in plastics may be carried out without smear or closing in of porosity and dimensions can be held to such fine limits that no running-in period is necessary.

A typical job by a custom molder was production of a small ring-shaped part, an insulating ring for a magnetic compass. As molded the part had a horizontal flash across the hole and on the diameter. The hole could be hand-filed at the rate of 150 units an hour, while the O.D. was filed on a machine at 400 units an hour.

With a diamond-tool setup one operator could turn out about 550 units easily and even went as high as 900 units an hour. About 230,000 of these pieces were produced without sharpening the tool.

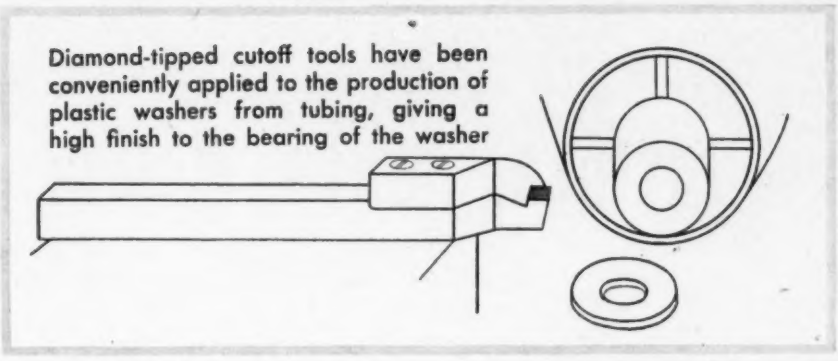
Glass-fiber phenolics are difficult to machine and impose a high rate of tool wear. A seven-facet diamond swivel-head tool with a facet length of 0.04 in., included angle of 175°, 5° clearance angle and zero rake angle was designed to bore the 3.8-in. dia. of a collet for a propeller shaft. Speed was about 500 fpm., feed 0.005 in. per revolution and depth of cut 0.005 in. and no coolant was used. About 500 collets were machined without resetting the tool. and after 1500 had been finished the tool was relapped.

Diamond cutting wheels, made of copper or steel plate with diamond powder cemented in slots on the periphery, are used for cutting test specimens of glass- and mineral-filled thermosetting and thermoplastic materials. Such wheels are usually from 0.030 to 0.060 in. thick, and a speed of 4500 fpm. is customary. About 25 gal. of water an hour is used as lubricant. No delamination or decomposition of the plastic takes place.

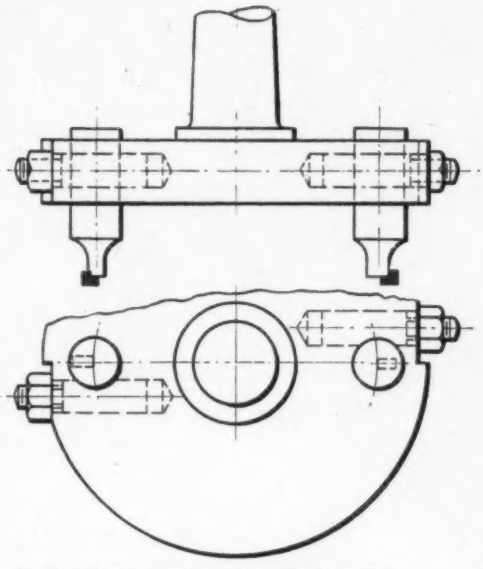
High-speed circular saws, set with four or more diamonds, are frequently used. Milling cutters with two or more inserted diamond edges are used for face milling, and diamond-tipped milling cutters, core drills, twist drills and countersinks are widely applied to forming plastics.

Removal of surface material from plastic parts affects the dielectric strength, and the finish will be slightly different than mold finish. However, in most work, the close dimensions are necessary only where the piece must be interchangeable in precision units.

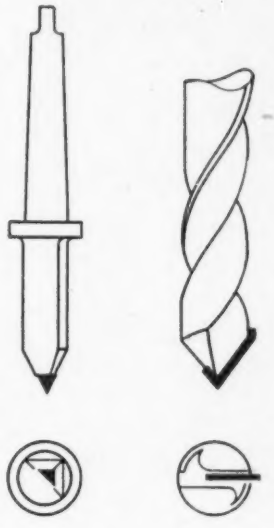
Where molding production of round pieces is high, diamond cutting operations are economical and give low cost per cut. Where production is low, increase in cost would only be for tooling as production cost would still be lower than by many other machining methods.



Diamond-tipped cutoff tools have been conveniently applied to the production of plastic washers from tubing, giving a high finish to the bearing of the washer



A flycutting action is effective in milling plastic parts, finish being satisfactory and the diamond tips equal to impact



Diamond-tipped flat drills and twist drills, by keeping heat generation at a minimum, reduce tearing of holes and gumming of thermoplastics

NOTE—*We acknowledge data supplied by Boonton Molding Company, Boonton, N. J., and Diamond Research Dept., Industrial Distributors (1946) Ltd., London, England.*

A MOLDING POWDER IS BORN

DISCOVERY of many modern plastic materials has often been attributed to lucky chance in the laboratory. Unexpected breaks, it is true, have been responsible for a number of new plastic materials, but the vast majority have been developed to meet a specific requirement.

Shortage of various metals during the war was the breeding ground of a number of new plastics. Often these substitutes proved to be superior to the conventional materials for the application and a lasting market was gained.

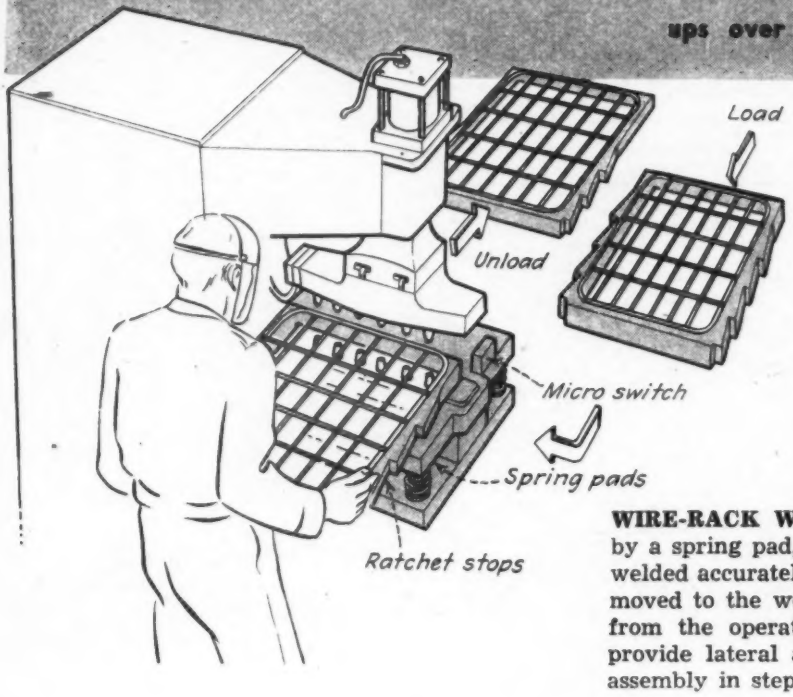
Development of a new injection-molding powder by Rohm & Haas technicians is typical of new material research. In this case, a material was required that combined certain properties of transparent acrylics and polystyrenes. The potential modifications of styrene copolymers would be endless and hundreds had to be synthesized and tested in the search for one having the required characteristics.

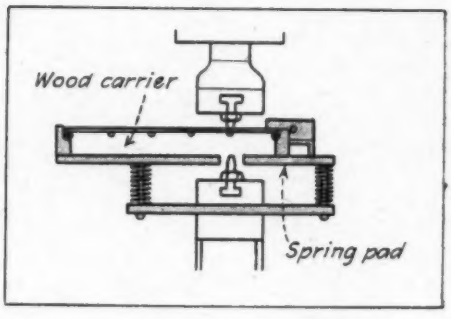
While this search ended in the laboratory, it all began with a fountain-pen manufacturer who wished to injection-mold his pen barrel. He found the available powders unsuitable because they were attacked chemically by certain writing fluids. Cast acrylic rods had the required chemical resistance but were not economical. In the absence of a usable molding material, the method of machining the cast acrylic rod was adopted and many pens made this way. Development of molding materials follows this pattern of fulfilling a definite need rather than depending on chance in the laboratory.

Fixtures Make Welders Flexible—I

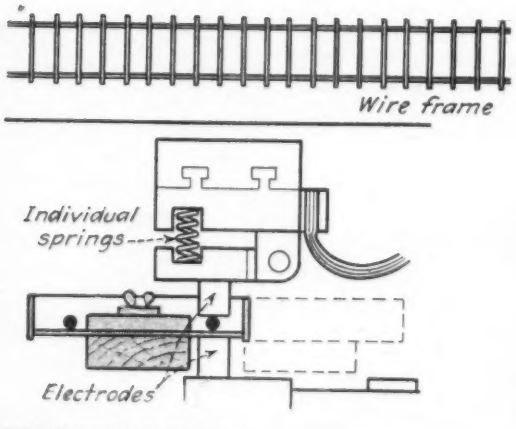
BY ED REILLY
WELDING ENGINEER
SPECIALTY EQUIPMENT & MACHINERY CORP.

Standard welding equipment can handle a wide variety of jobs if sound fixtures are used. Here are examples of current set-ups over a range of commercial items

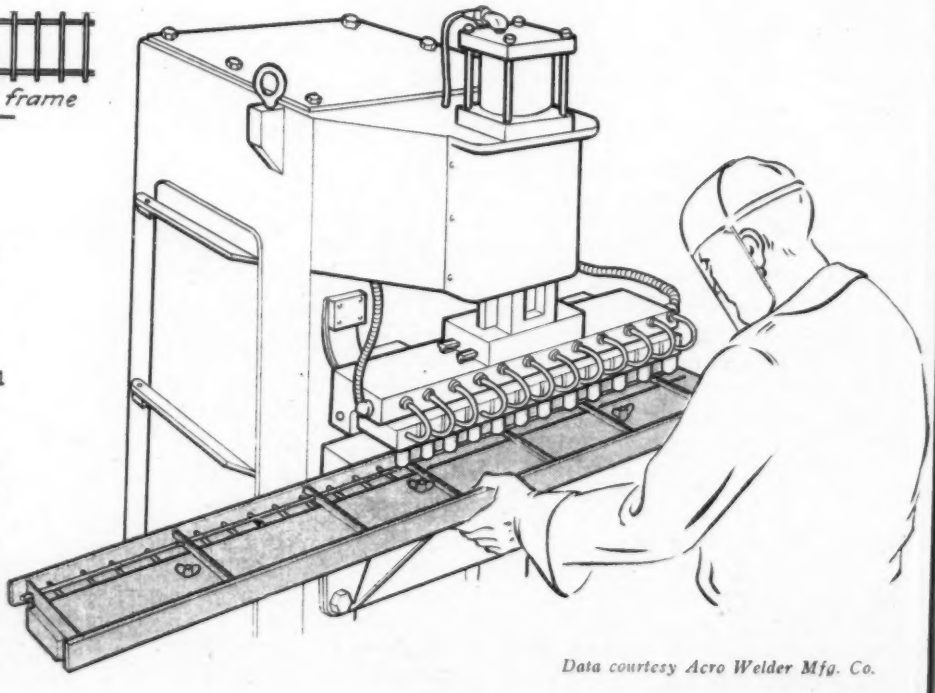




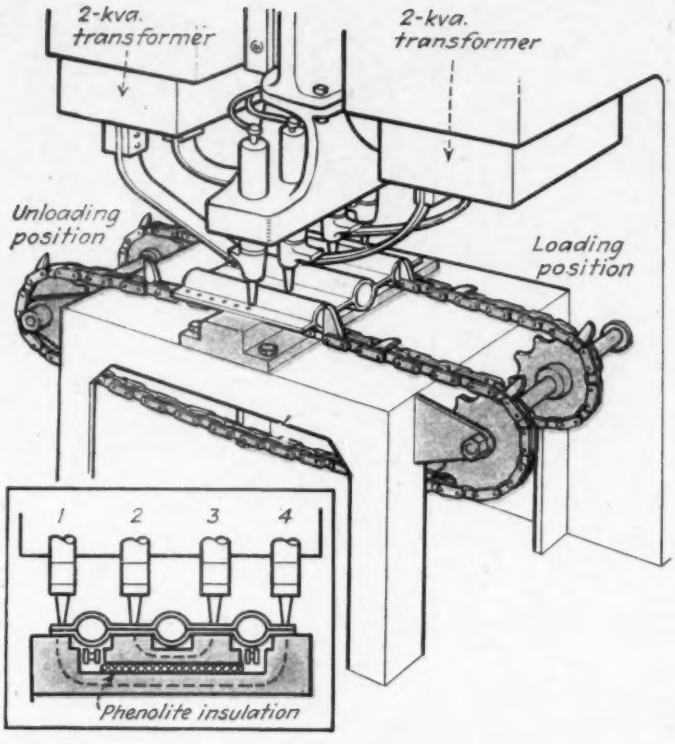
WIRE-RACK WELDING—A wood carrier jig, supported by a spring pad, enables wire-rack assemblies to be spot-welded accurately and quickly. Assemblies are pre-loaded, moved to the welding head on roller conveyor and away from the operation by the same means. Microswitches provide lateral alignment and ratchet stops position the assembly in steps



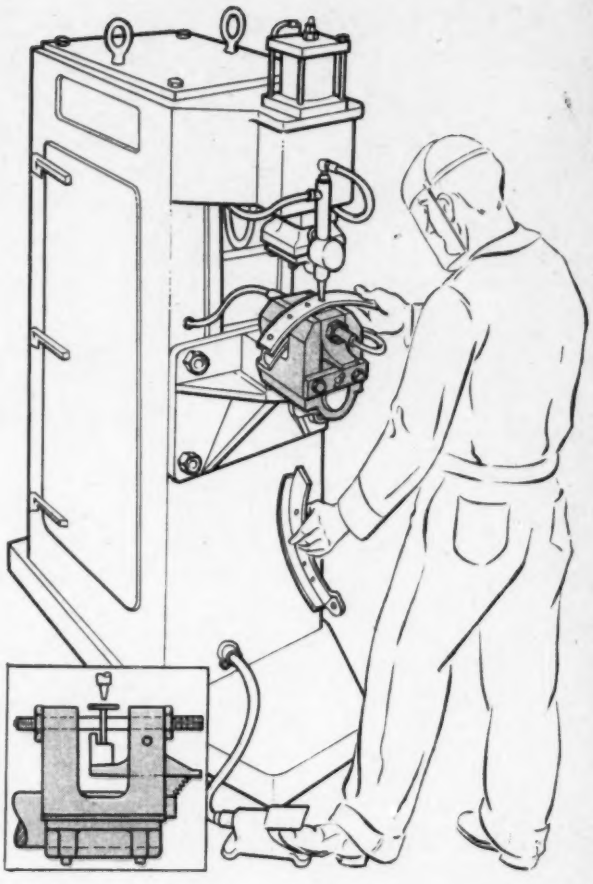
JUNCTION WELDING—12-point attachment on a standard spotwelder enables this wire frame to be welded in 4 passes. The operator receives the wire frame in a jig from the loader, makes two passes and reverses his jig. All welding points have individual springs and blocks for positive positioning of the junction to be welded



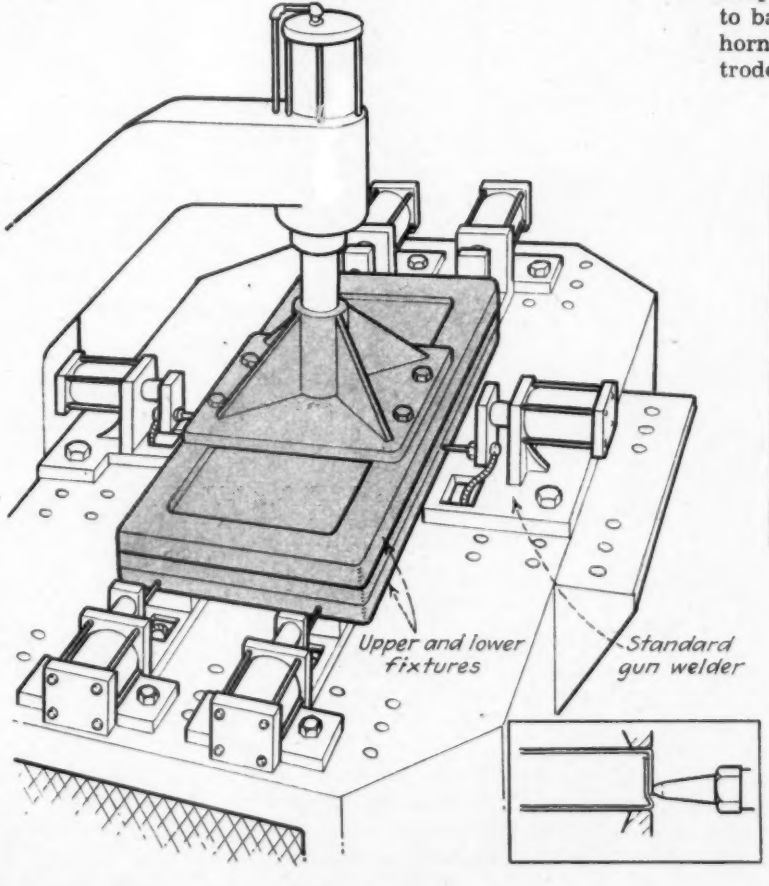
Data courtesy Acro Welder Mfg. Co.

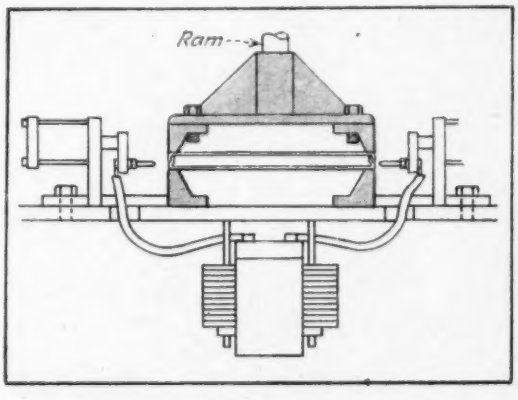


DOUBLE-SERIES WELDING—Materials handling and setup have been combined to speed assembly of evaporator sections. Two transformers, with controls interlocked for indexing, feed 4 welding points. A double chain carries the work load and is indexed with the ram motion for desired welding cycle. An auxiliary table carries the welding setup

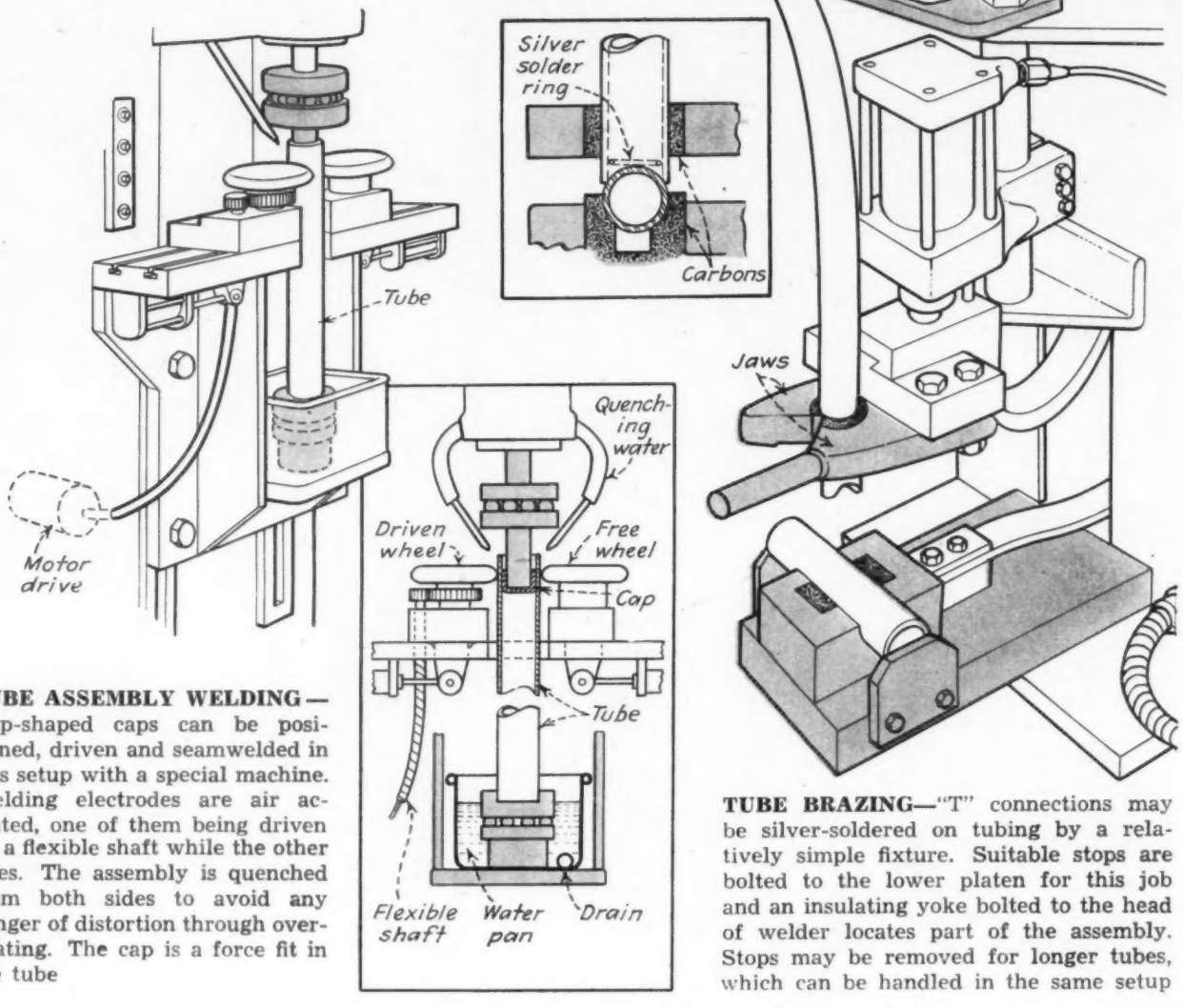


"T"-WELDING—A standard spotwelder has been adapted to production welding of brake-shoe webs to bands. A T-type fixture mounted on the lower horn positions the assembly and one of the electrodes is air-actuated to provide clamping force



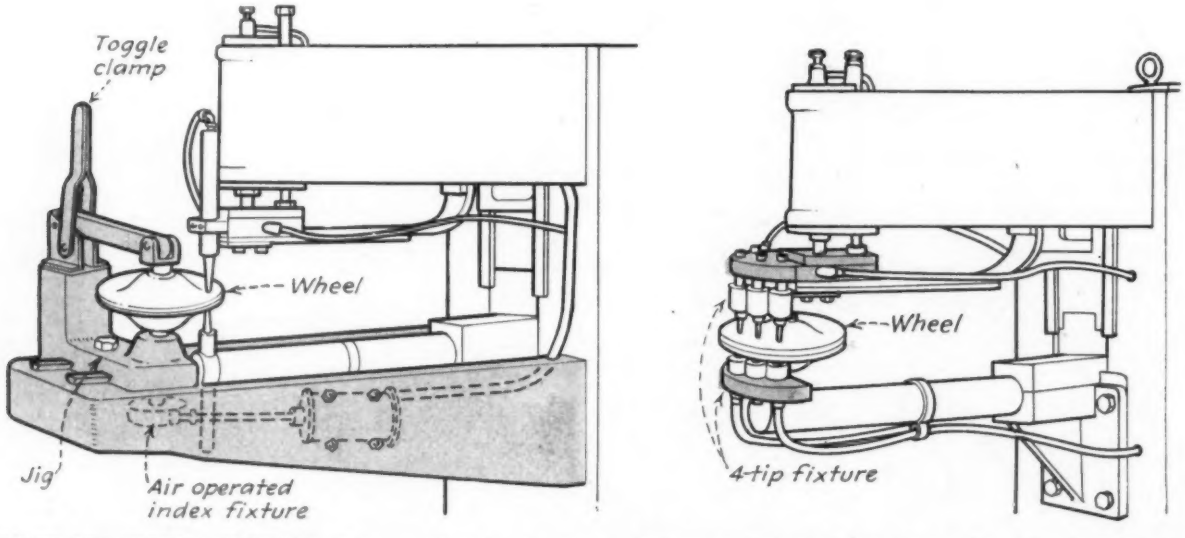


GUN WELDER SETUP—Standard gun welders, mounted on movable angle holders, enable a wide variety of square or rectangular frame assembly jobs to be handled. Here, a cabinet door edge is spotwelded at six points. Upper and lower fixtures in various sizes complete a flexible spotwelding setup, which can be readily lined up on the heavy mounting table

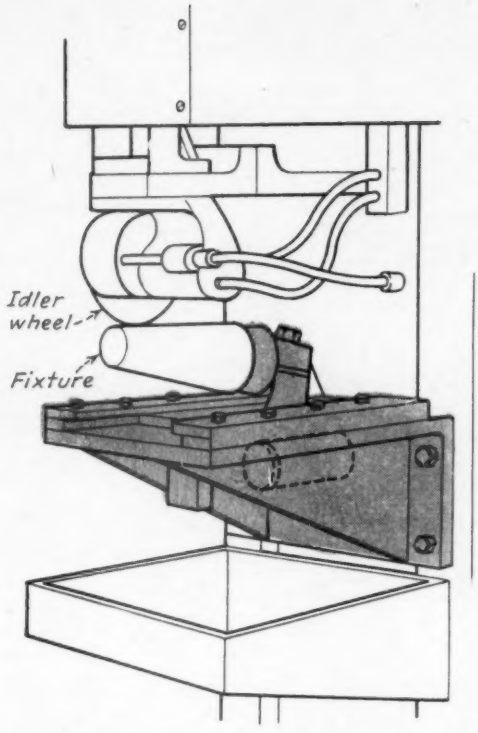


TUBE ASSEMBLY WELDING—Cup-shaped caps can be positioned, driven and seamwelded in this setup with a special machine. Welding electrodes are air actuated, one of them being driven by a flexible shaft while the other idles. The assembly is quenched from both sides to avoid any danger of distortion through overheating. The cap is a force fit in the tube

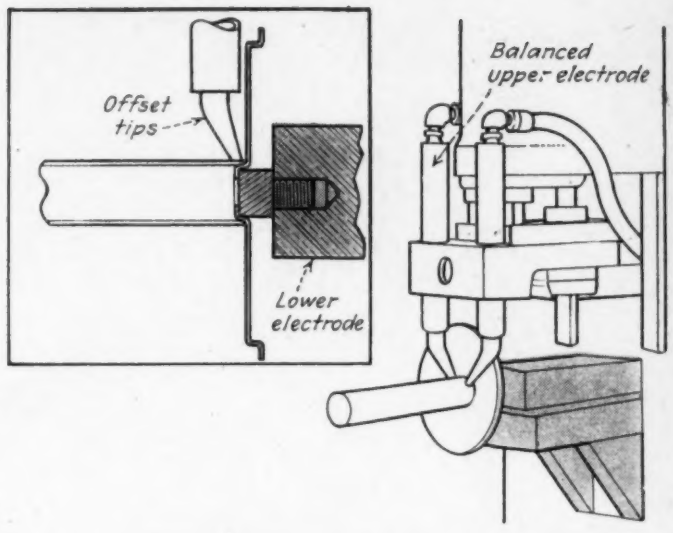
TUBE BRAZING—"T" connections may be silver-soldered on tubing by a relatively simple fixture. Suitable stops are bolted to the lower platen for this job and an insulating yoke bolted to the head of welder locates part of the assembly. Stops may be removed for longer tubes, which can be handled in the same setup



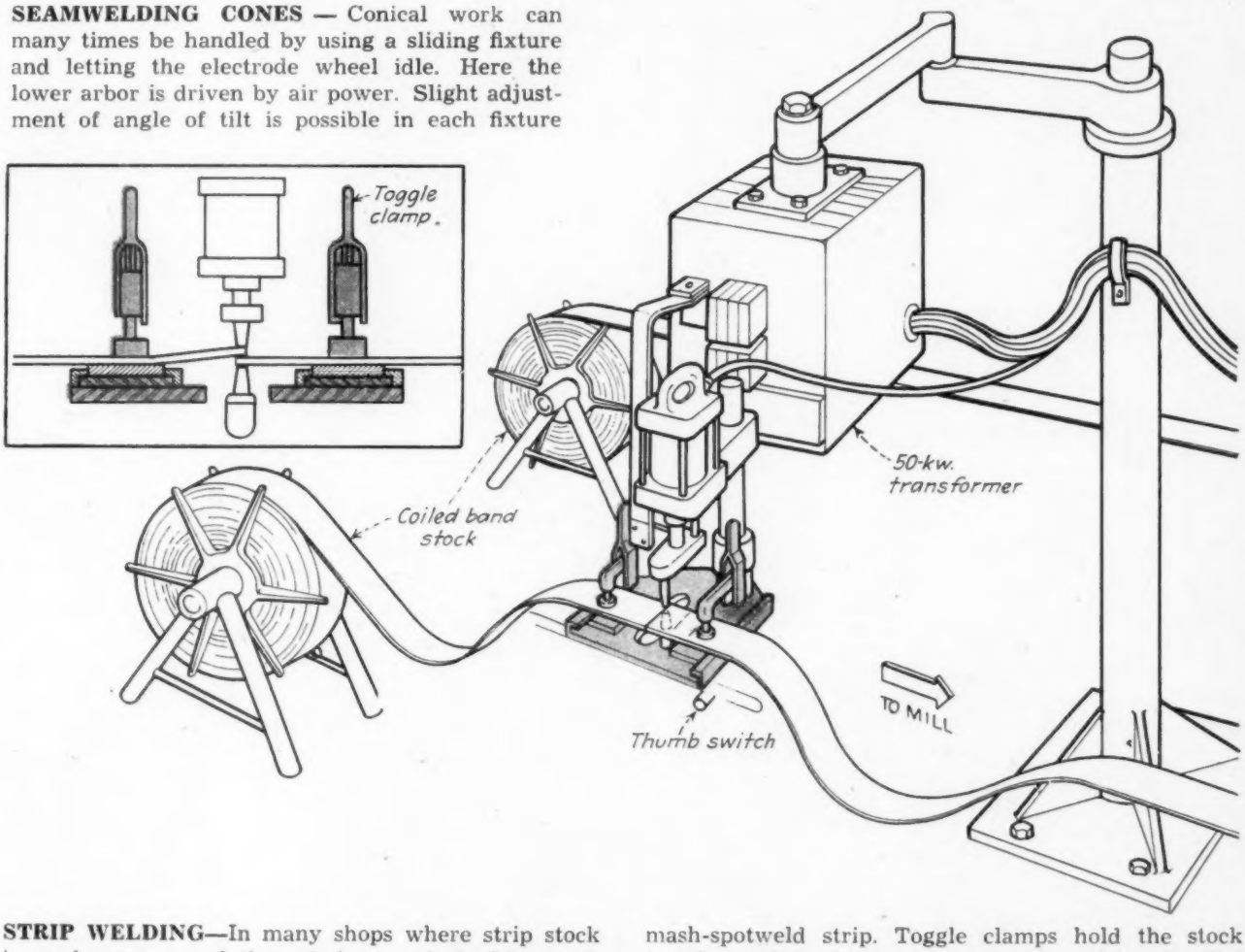
CIRCULAR WORK SETUPS—Two methods of assembling wheel or wheel-type parts involve adaptation of standard high-speed welders. The job may be done rapidly on a single-point welder, using an indexing fixture and placing the jig on slides to allow for adjustment. A 4-tip fixture on both upper and lower horns would enable the job to be done in two passes, with hand indexing replacing the air-operated units



SEAMWELDING CONES — Conical work can many times be handled by using a sliding fixture and letting the electrode wheel idle. Here the lower arbor is driven by air power. Slight adjustment of angle of tilt is possible in each fixture



DUAL-TIP WELDING—Assembly of flange-type disks to perforated tubing can be made in two passes by using two offset welding tips. Here the inner tube of an automotive oil filter is being welded to the disk. Electrodes are balanced and the work positioned by hand



STRIP WELDING—In many shops where strip stock is used, an accumulation of short ends builds up. A welding setup can recover these short ends and provide lengths of stock which can be economically handled for various strip operations. A portable gun welder mounted on a pivot fixture is used here to mash-spotweld strip. Toggle clamps hold the stock in place after the seam has been positioned. The gun welder is moved across the seam by hand and a conveniently placed thumb switch controls spotwelds. The pivot fixture itself can be moved about the plant and bolted conveniently to the floor

How to Apply PROFIT-SHARING

BY SPENCER A. TUCKER, SENIOR ENGINEER, CONSOLIDATED MANAGEMENT CONSULTANTS

This management engineer's experience with the hazards of profit-sharing led him to create a plan, now operating, which he regards as highly workable

AN EQUITABLE profit-sharing plan should be one in which the employee can share in the profits which he directly affects, according to his productivity, base rate of pay, and including such factors as absenteeism and longevity. Unfortunately, many profit-sharing plans now in effect are not really profit-sharing plans, but hybrid plans mixed up with pensions, suggestion awards, forced savings, and so on. The result is that all too many existing schemes do not meet the primary objectives of profit-sharing, or else are so complicated with extraneous arrangements that they fail in providing worker incentive.

Our experience with the effectiveness of such plans convinces us that a good profit-sharing plan must be kept separate and distinct from other existing incentive wage plans, retirement plans, and so on, so the worker can watch and measure them independently. To go further, we believe that maximum benefits to management and workers can be achieved by measuring the contribution of each employee to the profit, and calculating his share accordingly.

This is the basis for the plan I developed for one of our clients. Its primary purpose was to reduce labor turnover and absenteeism. However, individual productivity is also tied into the worker's share of the profits. Thus, the fund the worker receives during the period is based upon his average productivity, modified by his absenteeism, and further modified by a longevity factor.

Here's How It Works:

A special fund is set up for each employee. Each pay day the company pays into this fund an amount of money based upon the productivity of the employee. Productivity is indicated by a percentage reflecting the amount over standard (100%) produced by the worker. This basis is possible only if measurable standards have been set on the manufacturing operations, either for costing purposes or for use in an existing wage-incentive plan. To merit a "deposit," the employee's productivity for the particular pay period must exceed 100% of standard, because increased productivity contributes to increased profits.

If the company has an incentive plan in effect, incentive earnings above 100% productivity continue to be paid each pay day as before, but an amount of money proportionate to that same productivity is deposited on that pay day in the profit-sharing fund of that employee. This fund is collectible at the end of each successive employee fiscal year, or at time of discharge or resignation with certain penalties. Employees are automatically eligible when hired.

Profit-sharing credits are accrued to each pay day for the particular pay period, and no portion of such credits is ever applied against substandard productivity in other pay periods. It is also kept independent of regular incentive wage earnings.

To discourage absenteeism, each day absent is counted as three in calculating the absenteeism factor to be considered in the profit-sharing calculation. Employee turnover is discouraged by the longevity factor in the calculations.

With these considerations in mind, the formula for computing deposits to the fund each pay day is:

$$A \times B \times C \times D = Deposit$$

Where A = Weekly productivity in excess of 100%
B = Profit factor—depending on past and anticipated earnings (In this case 0.375 is used)
C = Hourly base rate
D = Total clock hours for week or pay period

Thus, if a worker achieves 125% productivity and receives a base pay of $1 per hr. for a full 40-hr. week, the week's deposit to the fund is:

$$25\% \times 0.375 \times \$1 \times 40 = \$3.75$$

Records may be kept cumulatively. On this basis, average productivity can be calculated easily by dividing total earned hours by total clock hours. In this case, *A* is equal to yearly average productivity in excess of 100%, and *D* becomes total clock hours to date.

Table I indicates the relationship between productivity and deposits on the basis of a 0.375 profit factor. Once the deposit has been computed, the absenteeism factor is applied thus:

$$\text{Final Deposit} = \frac{\text{Deposit X TWD—3 (each day absent)} \times}{\text{TWD in Year}}$$

Where TWD is total working days. Thus, if a man were absent 16 out of 250 working days and had accumulated a deposit of $260, the amount would be decreased by his absences to:

$$\$260 \times \frac{250 - 48}{250} = \$210.08$$

To help reduce labor turnover, the following table is set up:

LONGEVITY FACTOR

Length of Service, Mo.	% of Final Deposit Payable
3	40
6	60
9	80
12	100

After completion of one year's service, the percentage is never less than 100. The lower percentages applying to new employees are justified by the fact that higher earnings of newer employees are very often the result of the experience and direction of older workers. Whatever remains in the fund as a result of less than 12 mo. service or for any other reason may be distributed to an employee organization, as decided upon by the Profit-Sharing Committee.

To encourage longer service, the longevity factor can be carried forward with an extension of the previous table to reward workers in service with the company longer than one year:

Length of Service, Yr.	% of Final Deposit Payable
1-2	120
2-3	140
3-4	150
4-5	160
5-6	165
Thereafter	Plus 5% Yearly

These factors are variable for each industry, depending upon the skills and time factors involved for major jobs. In this particular case, the training period to full skill was three years, and the greatest incentive was provided for service up to three years, with the premium tapering off thereafter. In general, the longevity factor should be adjusted with the greatest incentive close to the full-skill period, with some allowances to discourage turnover where the training period is relatively short.

When this factor is applied to the Final Deposit figure, the net result is what the employee receives.

Despite various factors involved, the calculation is a simple one. To illustrate, we can take the hypothetical case of a worker who has been with his company three years and is looking forward to his third share of the profits. During his third year, he earned a base hourly rate of $1, and was absent six of the 260 working days of the year. The six absences result in a penalty of 18 days, cutting his attendance credit to 242 days. He has earned 2648 standard hours during his 2032 clock hours for an average productivity of 130% (2648 divided by 2032).

This is the way his profit share is calculated:

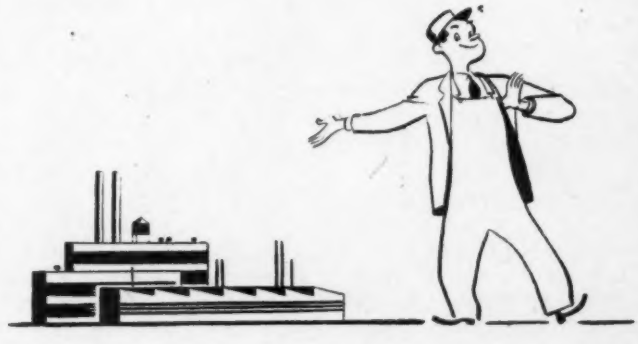
Productivity over 100%	0.30
Profit factor	X0.375
	0.1125
Hourly rate	$1.00
	$0.1125
Clock hours	X2032
	$228.60
Absenteeism factor (242 days ÷ 260)	X0.93
	$212.598
Longevity factor	X1.5
Share of profits	$318.897

Assuming the company was using the standard-hour system of wage incentives, his total earnings exclusive of profit-sharing were $2,648, of which $616 was incentive earnings. Including his share of the profits, the worker's total earnings were $2,966.90. Thus, his share of the profits made up over 10% of his total earnings, represent an impressive reward for his extra efforts during the year.

HOW PRODUCTIVITY AFFECTS WORKER'S SHARE OF PROFITS

(When Profit Factor is 0.375)

Productivity, %	% of Base Rate Per Hr. Paid into Fund
100	0
105	1⅞
110	3¾
115	5⅝
120	7½
125	9⅜
140	15



Abrasive Grains Produced Without Crushing

Good alumina abrasive is dense and pure. The inventor of a new process explains how unbroken crystals with these qualities are produced in one furnace step

BY R. R. RIDGWAY

ASSOCIATE DIRECTOR OF RESEARCH, NORTON CO.

THE DESIRABLE QUALITIES in an abrasive of crystalline alumina are high purity and a dense structure. These qualities are obtained to an increased extent by a new process which has the additional advantage of producing individual, unbroken crystals.

The most common type of alumina abrasive is formed by an electric furnace process in which bauxite mixed with coke and iron borings is fused and purified in a special furnace to produce an ingot which is about 95% alpha alumina with the remainder being such impurities as titania and silica.

This process has been widely used and many manufacturers have developed variations which have resulted in slight alteration of the purity and in the character of the impurities that remain, in order to produce grinding wheels with various desired qualities.

All of these variations are a great improvement over the natural corundum, which was used previously. However, they do not represent any fundamental change in the electric furnace process.

A second type of alumina resulted from the development of a method for purifying bauxite ore. Using this chemically purified aluminum oxide as a raw material for fusion in the electric furnace a crystalline alumina is attained which is about 99% pure and does not include any titania or silica among the impurities. However, this abrasive is porous and brittle, which causes it to break down in service. It is suitable for certain special purposes only. It is known commercially as "38 Alundum."

The porous structure was found to be the result of the chemical purification prior to fusion and no method of avoiding it has yet been found.

It will be seen that these two abrasives each excel in one of the qualities mentioned, purity and density, but not in both. A development program extending over about ten years has resulted in a patented process in which an alumina of better than 99% purity is produced in a single electric furnace step.

Bauxite is used with certain additions which melt at a lower temperature than the alumina and pick up the impurities. The additional materials (other than the customary metallic iron and coke) are an alkaline metal or alkaline earth metal to absorb the impurities and a disintegrating agent. Iron pyrites (iron disulphide) is preferably used as the former and soda ash, magnesia or lime as the latter.

A typical proportion by weight for charging the furnace is as follows:

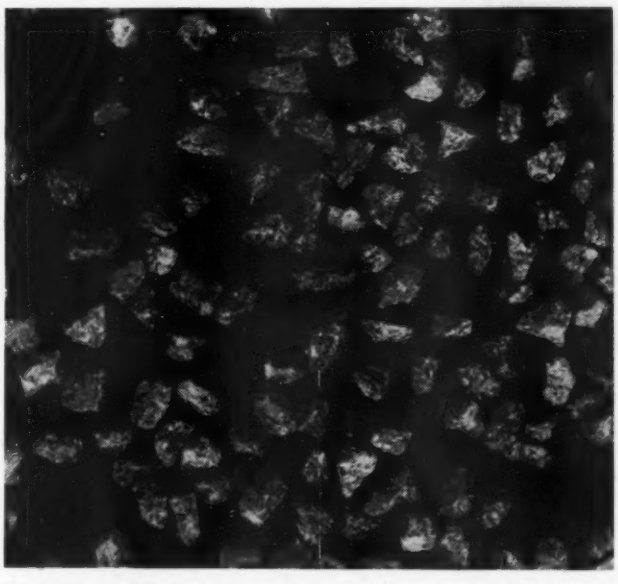
Material	*Parts*
Bauxite	74
Metallic iron	15
Coke	6
Iron pyrites	4
Soda ash	1

After the mass is fused it is allowed to cool slowly at room temperature. Separate crystals of alumina grow in a sulphide matrix which contains the impurities. This matrix, about 3% of the total, is unstable and will disintegrate in the atmosphere in about three weeks.

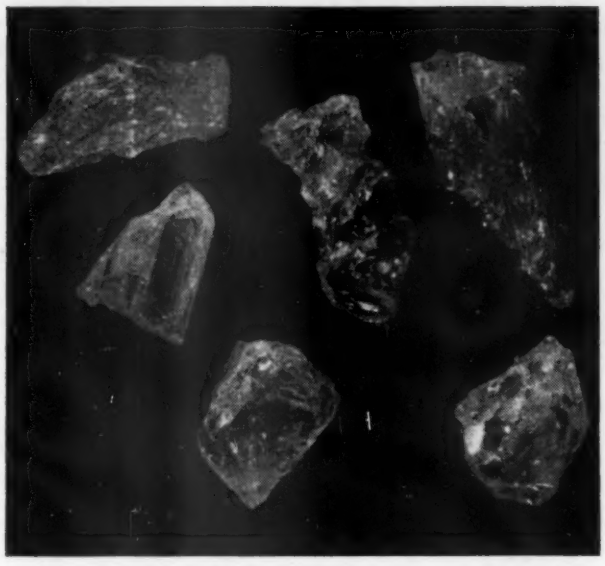
In practice the ingot is crushed into large lumps which are placed in a lime slaker. The disintegration is speeded by moisture, agitation and heat. The lime slaker is a slowly rotating drum in which the lumps of abrasive are placed with water just below the boiling point. This decomposes the unstable matrix in about 12 hr. The resulting abrasive grains are screened, washed and dryed and put over magnetic separators to remove any fine particles of ferro-silicon that may remain. The grains are then roasted and screened for size.

The grains resulting from this process are known as 32 Alundum. They have a very dense structure and a purity averaging better than 99%. What impurities remain are in thin films through the crystals.

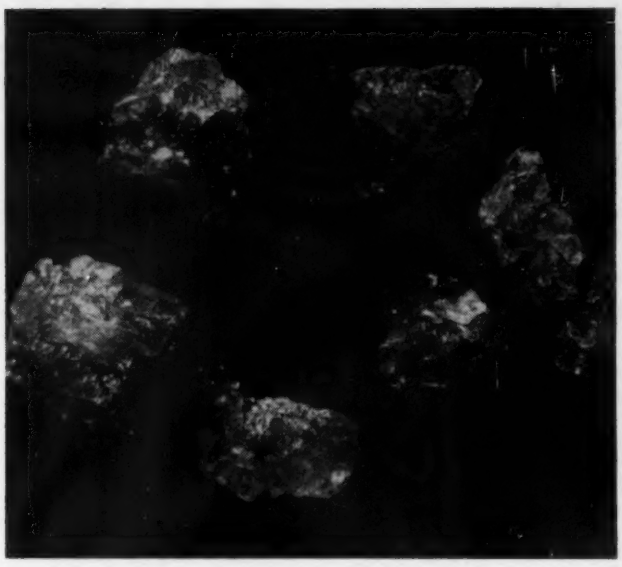
The crystals differ also from other alumina crystals in that they are formed as individual rather than interlocking crystals and are separated by disintegrating the



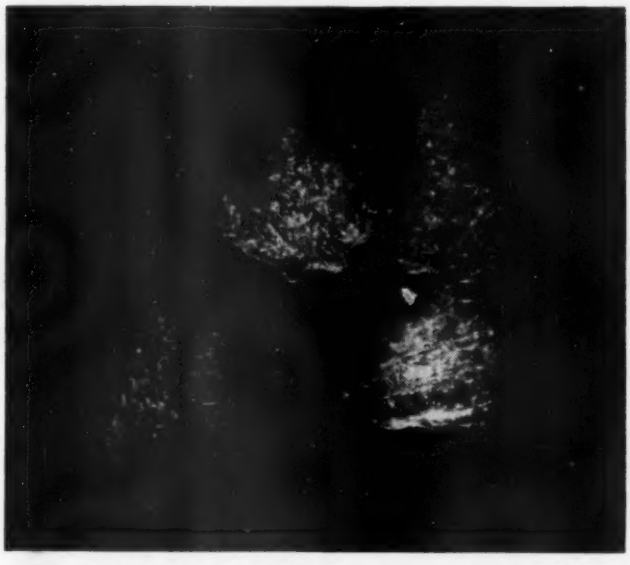
PHOTOMICROGRAPH of the grain surface of regular Alundum size 46 at 20 diameters magnification. The smooth fracture faces result from crushing the ingot to produce desired grit sizes from the interlocking crystal structure



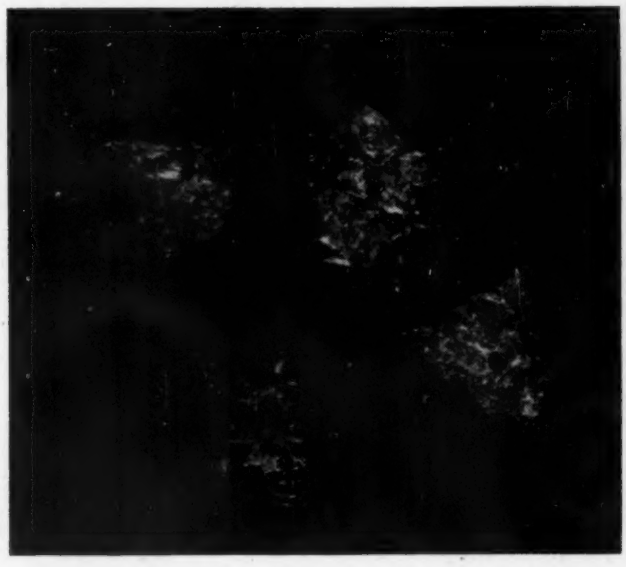
THE GRAIN SURFACE of 38 Alundum size 24 at 20 diameters magnification also shows smooth surface resulting from grain fracture



THE NEW ABRASIVE size 24 at 20 diameters magnification shows an irregular, nubbly grain surface which is assumed as the crystals solidify



THE GRAIN INTERIOR of 38 Alundum at 20 diameters magnification shows the porous structure caused by bubbles and cylindrical capillary openings



THE FILMS OF IMPURITY distributed through the new abrasive grains are shown in this photomicrograph of the grain interior of size 24 at 20 diameters

matrix rather than by crushing. These whole abrasive grains have a chunky, nubbly shape well suited to grinding wheels. Fortunately the range of sizes obtained (this range is largely determined by the rate of cooling) can be made to correspond with the grit sizes which are required by industry.

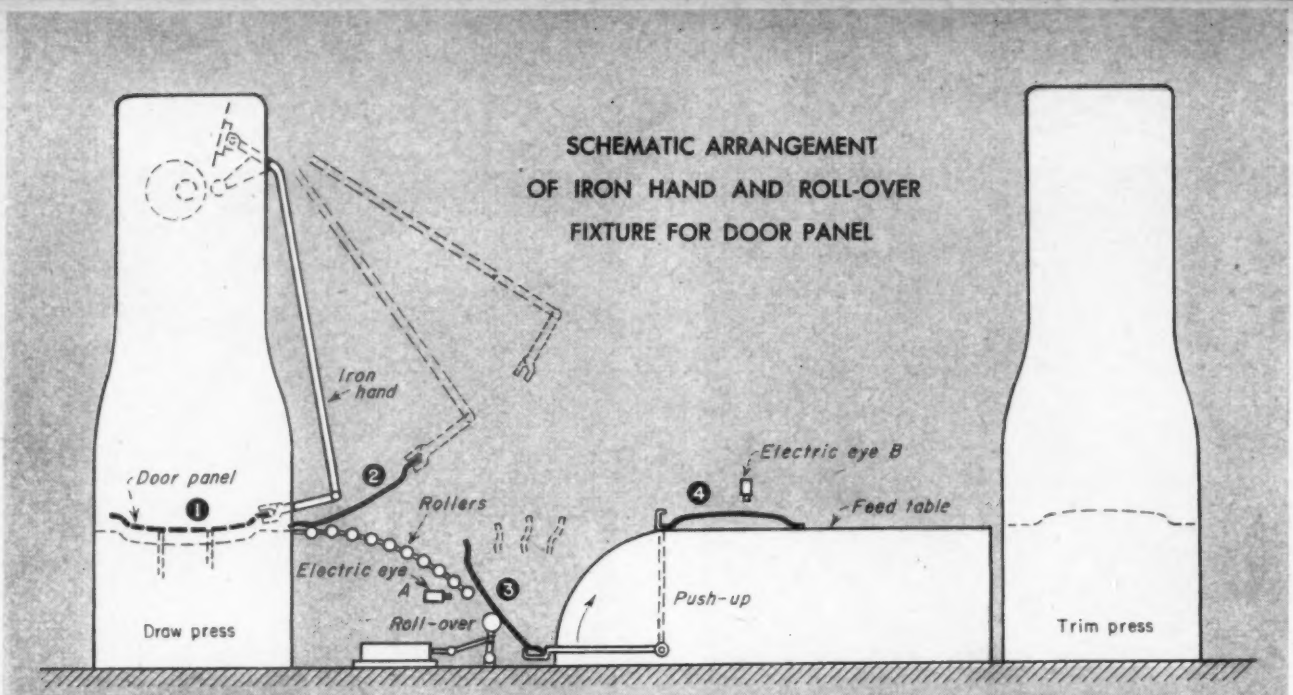
An example of the grain sizes obtained is given below. In this case 5% iron pyrites and 1% lime were used as the additives. The division is by the percentage held on screens of the meshes indicated.

Screen size	10	24	44	66	100	Finer than 100
Percentage held	13.5	6.3	39.8	21.9	10.7	7.8

When bonded to form grinding wheels the abrasive has been found to cut fast and cool. The exterior surface of the grain with its many angles and planes forms an initially good cutting edge. As the surface of the grains wears down they are believed to shear off along the planes of the impurity films, which brings new cutting edges into being in the same crystals.

The new wheels are at present being made with vitrified bond for tool grinding, surface grinding, and internal grinding and resinoid bond for snagging and weld grinding. As development continues, it is expected that they will be used for other types of grinding—in fact they are already showing up well for cylindrical and centerless grinding.

Tests indicate that it is usually possible to use a wheel that is one, two, or even three grades harder than with the regular alumina wheels. Except with internal grinding the finish obtained is often not as fine with the new abrasive. A comparable finish can be obtained by using a wheel that is one grit size finer.



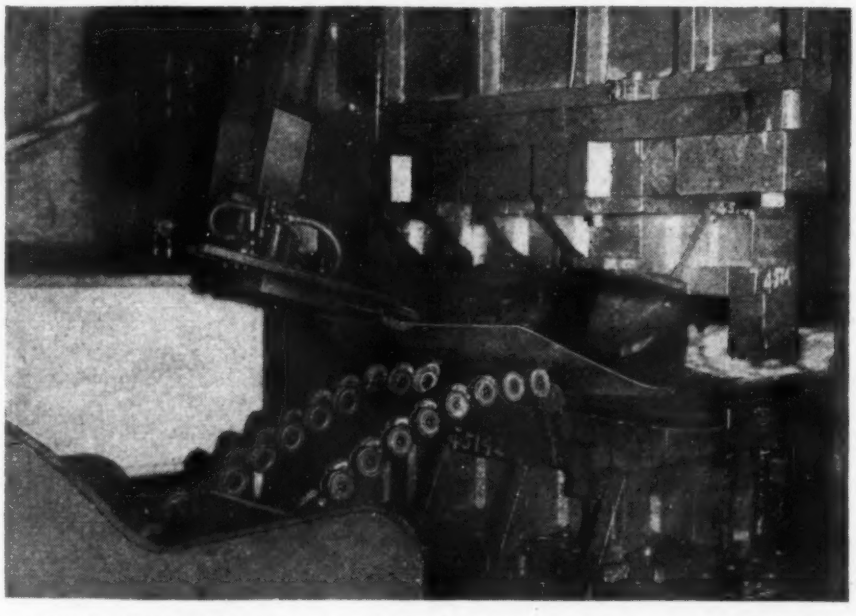
Handling steps for the door panel are: Position 1—Pressure pads or pins lift stamping off lower die as ram starts to rise; Iron Hand reaches in, its jaws snap shut on scrap edge; Position 2—Iron Hand pulls stamping onto roller table and jaws release; Position 3—Falling stamping intercepts beam to electric eye A, and roll-over pushes stamping onto face of feed table, weight of stamping trips push-up bar circuit; position 4—Stamping is pushed onto feed table at convenient position for handling by the trim-press operator

FISHER BODY DEVISES AIDS FOR PRESSED-METAL HANDLING

Installations at Flint typify skill in development of mechanical substitutes for manual effort

By RUPERT LE GRAND
ASSOCIATE EDITOR

USE OF MANPOWER in Fisher Body press rooms is more effectively employed by minimizing situations requiring manual handling of bulky stampings between operations. The lifting of unwieldy panels in and out of presses and moving them to the next operation, can give rise to complaints about the energy that must be expended. Besides, unproductive labor of this sort is uneconomical. For these reasons enough room is provided between equipment to install mechanical handling aids. Many of these are of its own design; others are manufactured products that have been inspired by company engineers. An example of the latter is the motorized slat conveyor which takes a deep-drawn stamping ejected from one press and conveys it directly to the next press, where the operator has little difficulty in placing it in



NO DELAY AT PRESS—The Iron Hand is shown as it starts to pull a door panel out of the draw die, while operators at the front of the press begin to feed a new sheet. Thus the press can be worked at its maximum rate

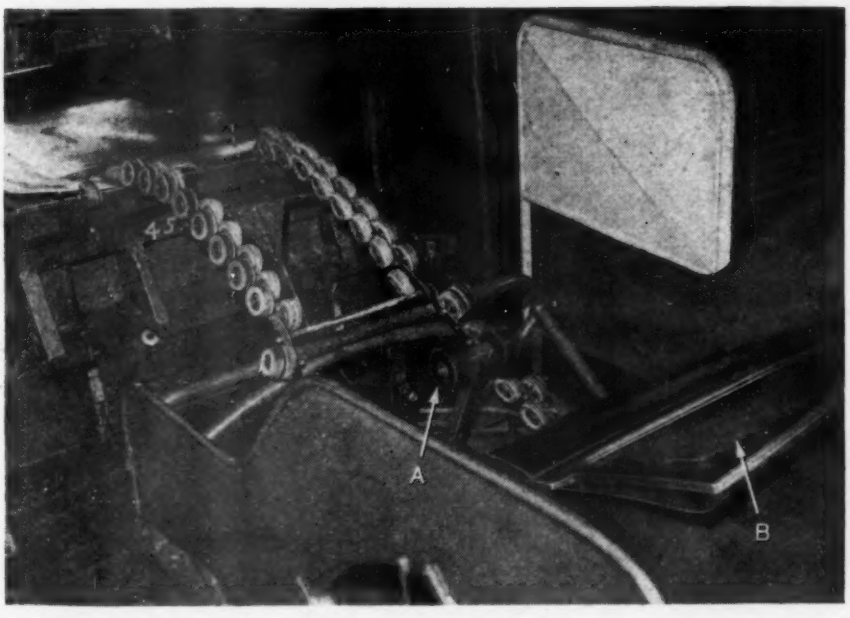
the dies. Slat conveyors of this sort are widely used at Plant No. 1 in Flint. Portable motor-driven booster conveyors that pick up a piece kicked out of a press and convey it up a belt and drop it into a skid box are also employed.

But this article is concerned mostly with mechanical-handling aids that Fisher Body has designed and built for its own use. Some of these designs have been evolved from several years of experience, but are apparently little known elsewhere.

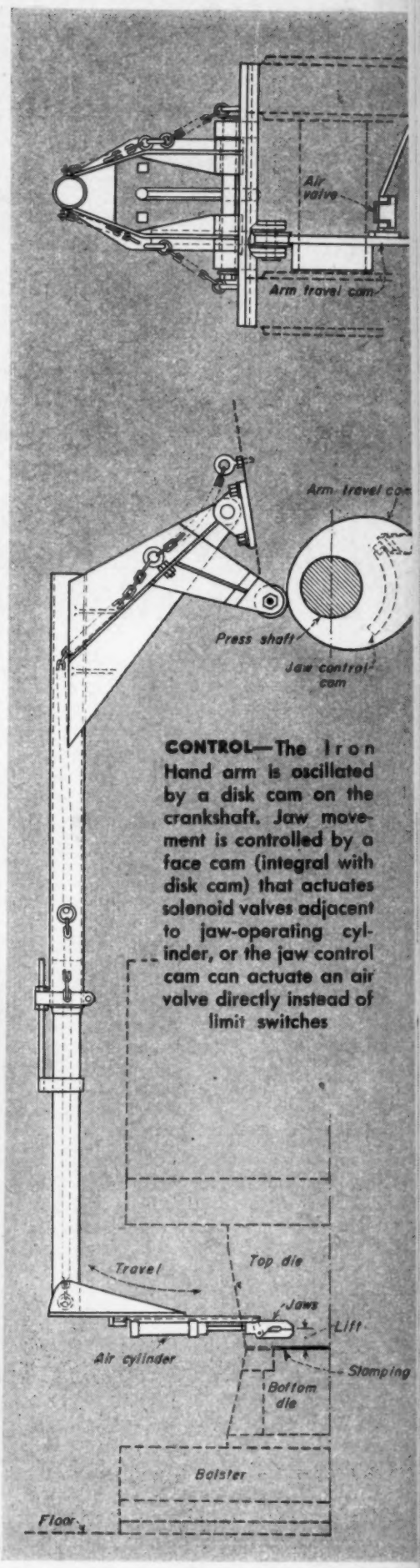
The "Iron Hand" — Safety, unimpeded press operation at speeds up to maximum for machine and avoidance of the human element in removing stampings from dies are achieved with a device called the "Iron Hand." This is a long arm that hangs down the rear of the press and terminates in a pair of air-operated jaws. Upper end of the arm is pinned to a bracket fastened to the press head. The arm is caused to swing in an arc by a disk cam fitted to the crankshaft. Thus, arm movement is timed in relationship to ram movement. A face cam fitted to the disk cam operates an air valve, which controls jaw operation.

Here is how the Iron Hand works on the draw press for the outer door panel: When the upper die starts to descend, the arm is in the back position. No arm movement occurs until the dies close. Then the disk cam allows the arm to swing down, with the jaws almost touching the tools. Here the jaws rest until the dies have opened several inches. In the meantime, the stamping is lifted to the level of the jaw centerline by means of pressure pads. At the proper instant, the disk cam allows the arm to insert the jaws between the dies, and during inward travel the face cam opens the jaws. The jaws snap shut on the scrap edge of the stamping, the arm sweeps backward and the jaws pull the panel out of the dies. The jaws release the door panel as it falls upon a downward curving track fitted with cloth-faced rollers. The stamping now drops into a roll-over fixture, the shock being taken on the scrap edge.

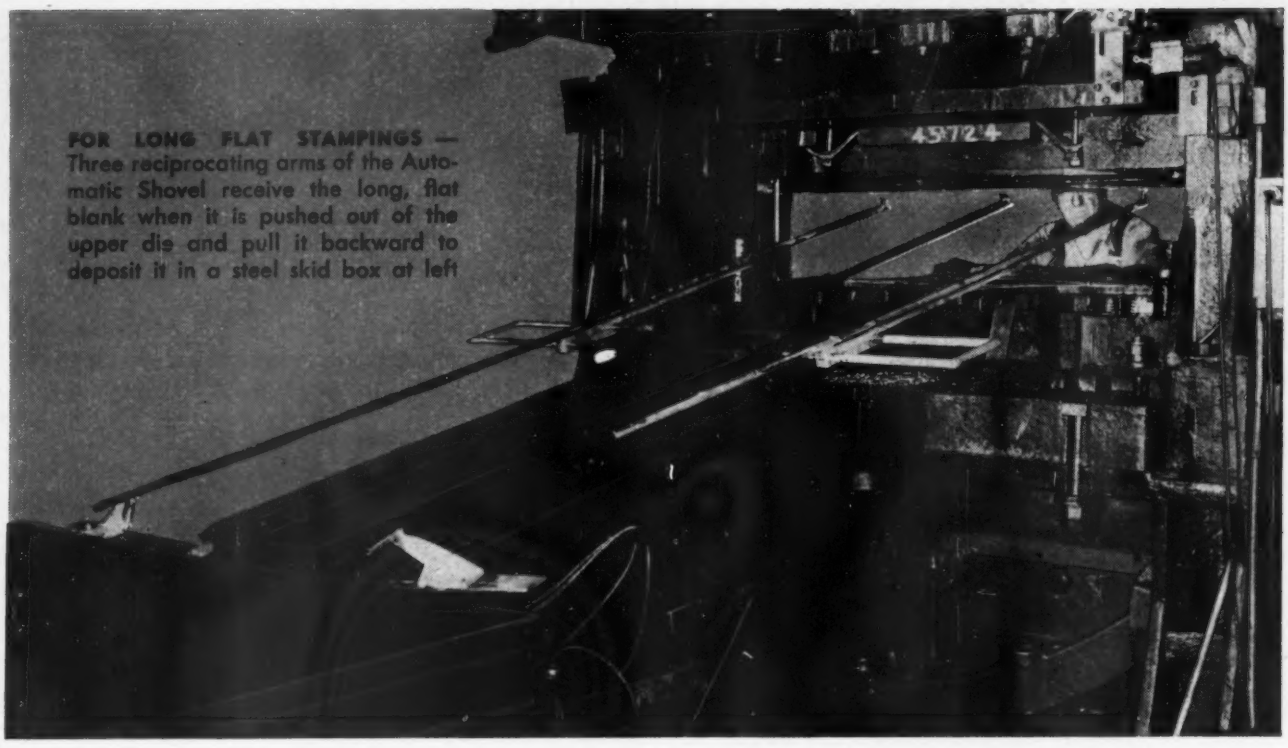
Two actions occur in the roll-over fixture: First, the panel interrupts a light beam, and a photo-tube relay energizes circuits controlling a pneumatic kick-over mechanism. An arm fitted with two fiber-faced rollers pushes against the center of the panel and throws it over onto the circular nose of a feed table. Second, the weight of the panel trips a circuit that causes a sweep arm to lift and guide the panel over the round nose of the table and push it into feeding position at the press. Now the press operator can position the panel in the trim die with little effort. A second electric eye setup above the feed table prevents the sweep arm from operating if there is a panel already on the table. Thus, the roll-over fixture turns the panel over for proper position in the trim die and puts it under the hand of the trim-press operator. The combination of Iron Hand and roll-over



OVER IT GOES—Roll-over A has operated, throwing door panel B onto the curved face of the feed table for the trim press. Thus, the panel is automatically turned over into position for trimming



CONTROL—The Iron Hand arm is oscillated by a disk cam on the crankshaft. Jaw movement is controlled by a face cam (integral with disk cam) that actuates solenoid valves adjacent to jaw-operating cylinder, or the jaw control cam can actuate an air valve directly instead of limit switches



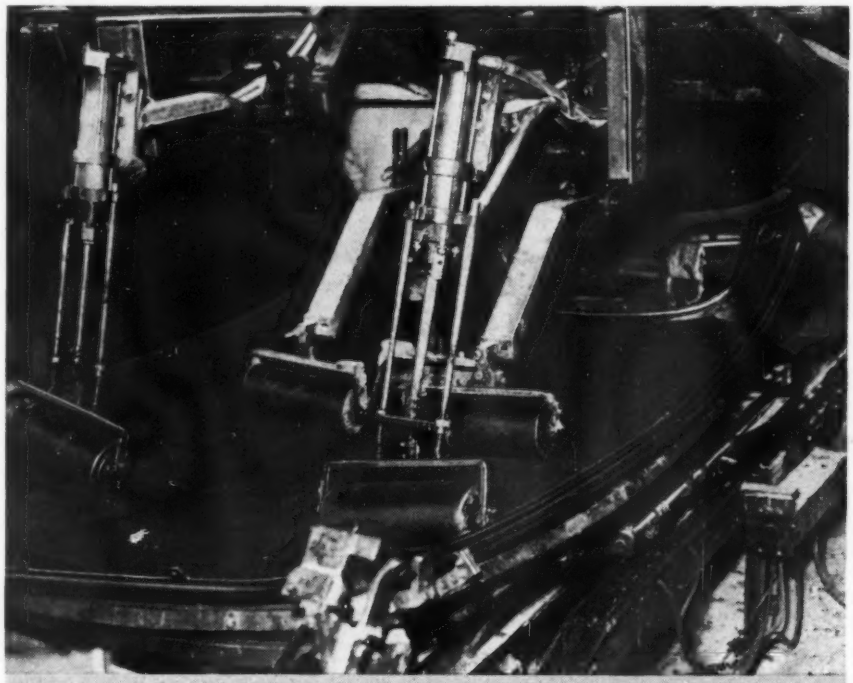
FOR LONG FLAT STAMPINGS — Three reciprocating arms of the Automatic Shovel receive the long, flat blank when it is pushed out of the upper die and pull it backward to deposit it in a steel skid box at left

fixture avoids a lot of manual effort and cuts down marred panels.

The Automatic Shovel—Long, whippy stampings like the inner-roof rail (first-operation blank) are difficult to remove from the press without slowing down the operator or adding the hazard of a helper. Hence on such operations, the "Automatic Shovel" permits the press to be operated at maximum speed. This device is actually a machine, placed at the rear of the press and timed to operate with it. A roller carriage that reciprocates on an inclinable track bears three arms terminating in hooks. When the press ram rises, the stamping is carried along in the upper die. At the proper instant the ram trips a limit switch controlling a high-speed electric drive to the carriage. The carriage rolls swiftly to the outer end of its travel and the arms are put under the stamping. Knockout pins eject the piece, which falls upon the arms. In a twinkling, the carriage reverses and the arms kick the stamping down the incline and into a steel skid box.

The Automatic Shovel is mounted on wheels and is thus easily transported to any press job requiring its services. Pointed screw jacks hold the device firmly in position on the wood floor. The inclined carriage can be cranked to the correct level by a screw and bevel gear arrangement. Flexible leads are plugged into connections at the press, and the Automatic Shovel is ready for operation.

Rube Goldberg Was Here—Fascinating to watch, the machine that rolls the sound-deadening liner into the turret top is really a prime example of how mechanical ingenuity can transfer much manual labor to an assembly of motors, levers, limit switches and air cylinders. Sub-assembly operations on the turret top are carried out on a merry-go-round conveyor with machines placed at intervals to perform various operations. At one point in the cycle it is

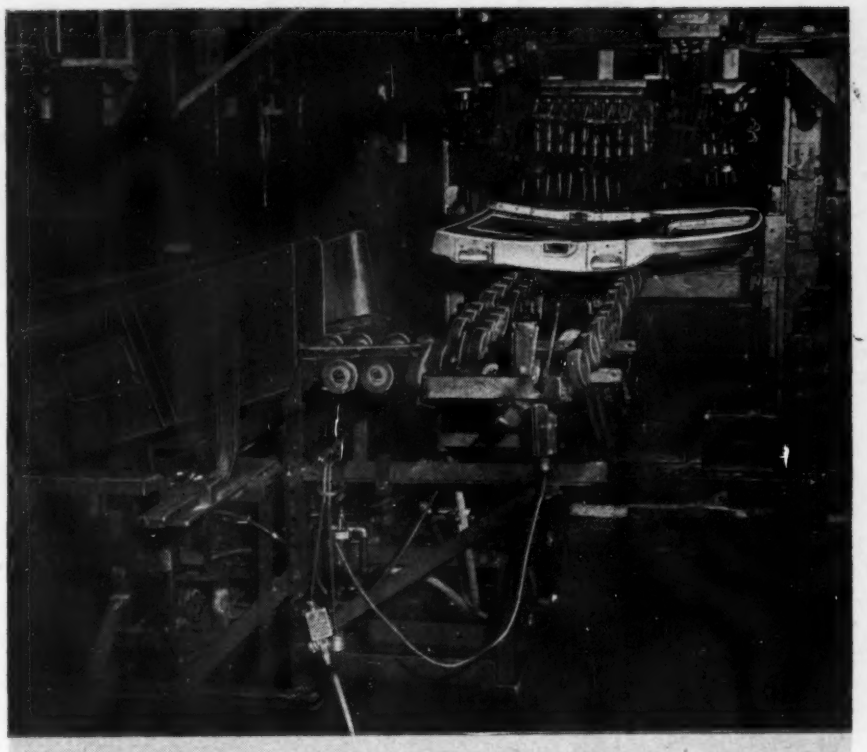


AUTOMATIC HANDS—Sound-deadening material is rolled into place in the turret top by a mechanism that reproduces the movements of two operators, produces a more uniform job

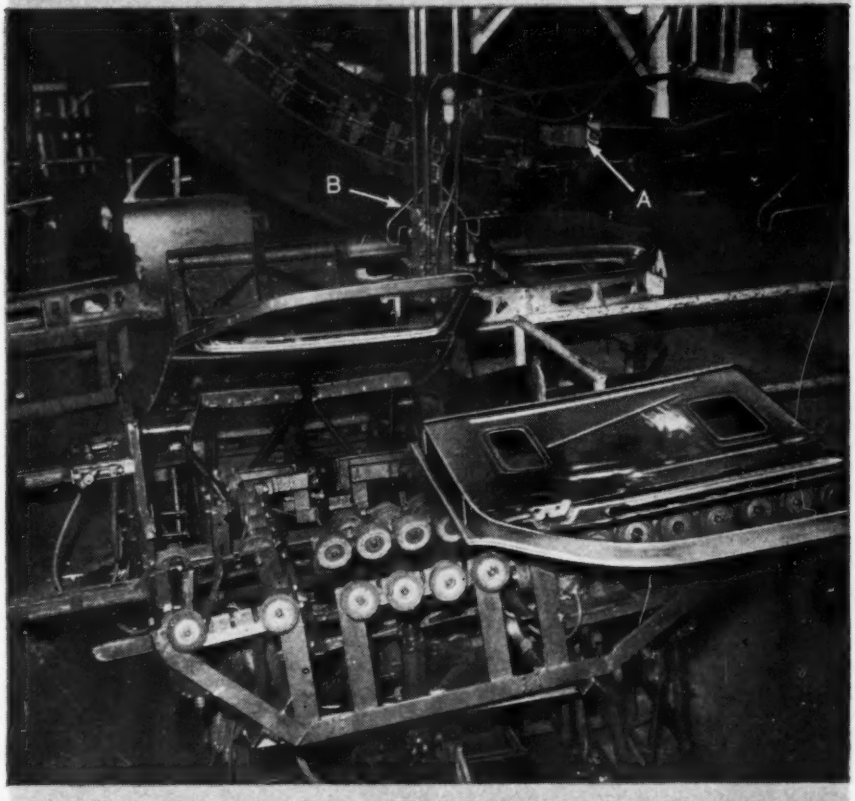
necessary to insert the sound-deadening liner and roll it down firmly on adhesive. The panel itself is wide, placement of the liner and rolling it down by hand constitutes one of those jobs where operators would be required to bend over, reach and keep pace with conveyor movement —altogether a job not well fitted to the mechanics of the human body. Hence a machine was designed to handle this operation. Straddling the conveyor, this machine has four roller arms held by a rocking framework. When a conveyor dolly reaches the proper point, it trips a limit switch, the frame is rocked downward and the rollers come in contact with the liner. The arms reciprocate slightly to roll down the corners and front edge of the material, then remain stationary as the panel moves underneath. When the back end of the panel approaches, the two forward arms lift, then the rear set, after which the framework rocks upward to the inoperative position awaiting the next panel.

Conveyor Loaded Automatically—After the inner and outer door panels are assembled by multiple spot welding the hem, the problem is to remove the bulky, heavy door in pace with the machine and hang it on a conveyor. And in so doing, it is essential that the finely finished outer panel not be marred to avoid excessive finishing costs.

The solution at Fisher Body is the combination of a run-out table and roll-over fixture which operate without attention. When the welder head lifts, the completed door is pushed out of the machine by an incoming assembly. The door moves down the run-out table by gravity, the table consisting of tracks fitted with cloth-faced wheels turning on roller bearings. At the end of the table, the door comes in contact with a switch bar, and a push-up operates. The door is raised and tilted to about 30 deg. from the horizontal, then slides into a slot in a geneva-type wheel in the roll-over mechanism. Placed cross-wise to the roll-over fixture is an overhead chain conveyor with hooks spaced at intervals. When a hook approaches the roll-over fixture, it trips a limit switch placed adjacent to the chain. Thereupon, the geneva wheel indexes in timed relationship to conveyor movement so that the door is put onto the hook at the correct instant. In use, this equipment operates hour after hour without making a mistake, and no attendant is required.



NO HANDS TO MOVE DOORS—When the welder head lifts the completed door is pushed onto the roller track, down which it moves by gravity to a stop. Then the door is tilted to enter roll-over fixture



HUNG ON CONVEYOR—Limit switch A has been tripped by conveyor hanger B, and geneva-type roll-over is lifting door to put it onto the hanger at the proper instant of conveyor movement

TALKING SHOP

Wetter Water

HYDRAULIC tests for casting porosity are now standard at many plants, particularly with currently poor workmanship and casting quality. But even at 50 psi., hydraulic tests do not show up some gas leaks. One plant thereupon installed a costly unit to apply air pressure to castings immersed in water, determining relative porosity by the quantity of air bubbles. At another plant they found this expense could be avoided by adding a few drops per gallon of water of one of the many wetting solutions used in cleaning baths. This reduced surface tension enough so droplets of water, even under reduced hydrostatic pressure, oozed through pinholes or imperfect joints that didn't show up under 50-psi. water alone. Expensive changes in test equipment were thus unnecessary.

6-Ton Ford

LATEST reports have it that six tons of coal go into every Ford during manufacture—for coke, power, transportation of materials on the Rouge and outside railroads and in making purchased steel. Thereafter, the Ford is like our furnace, interested only in gas.

Planning Is Manning

MANNING for the future, rather than planning, is suggested by Rogers & Slade as sound business practice. They point out that many carefully laid pre-VJ plans have "gang agley" because events have not followed the expected course. The idea is to stop trying so hard to anticipate the future and to invest more time and energy "in building an organization capable of meeting the future with intelligence, flexibility and resourcefulness."

Do you Hob or Hub?

IT'S GETTING so nowadays a poor guy doesn't know whether he is hobbing or hubbing. The Metals Handbook of the ASM makes this distinction:

HUBBING—a method of displacing metal.

HOBBING—a method of removing metal.

Production of polished mold cavities by displacing metal is thus properly referred to as "hubbing," and "hobbing" refers to gear and spline cutting processes. But by far the greater number of firms engaged in hubbing (by definition) call it hobbing too. We bow to common usage. However, some companies have tried to clarify the muddle with "die hobbing" as distinct from "gear hobbing." If we are confusing people, maybe we could use our hands.

Too Smooth

SMOOTHNESS is not always the answer in solving bearing troubles. In one type of bomb nose fuse the firing pin and the plate on which it slides are both zinc-base die castings. Both were machined to smooth surfaces—causing cohesion which interfered with free sliding. Blast cleaning roughened the surfaces slightly, permitting proper functioning, according to American Foundry Equipment Co.

Union Discipline

A BUNCH of the boys were sitting around at the close of an ASTE meeting in one of the better gin mills, discussing the pros and cons of labor and unions in general. We decided it was getting a bit late and hailed a passing waiter. "Waiter, could you tell me the right time?"

"Sorry," says he, "It's not my table."

N. T. KELSO, fractional-hp. motor engineer for G. E. at Fort Wayne, Ind., is the latest to succumb to daffynitus. Here are some selections from his symptoms:

DEAD CENTER—A hunting dog mistaken for a deer.

CHASER—Something that follows something else.

COLD CHISEL—Ice pick.

CROSS RAIL—Keep your feet off and it won't get cross.

DIAMOND BORING—Top-notch gold-digging.

DIE CHASER—The emetic following a swig of dye.

TRIMMING DIES—Coloring matter for lace and such.

DRIFT—What you cannot do and expect to succeed.

FIN—A 5-spot.

FLASH—Precedes a bright idea.

FEELER GAGE—A device for determining how far you should go.

WORM GEAR—The pedals on a caterpillar.

HACKSAW—The cut-off for a copy writer.

UNIVERSAL JOINT—Home.

NICKING TOOL—A sweet young thing operating under the direction of a designing mama.

PILLOW BLOCK—A device on which a line shaft sleeps.

PROFILING MACHINE—Beautician.

RELIEF—What most of us want even if the war isn't officially over.

BAND SAW—The fiddler in the back row.

SCARF—Headgear for a bobby soxer.

TAX REMOVER—Anti-saloon league (if they have their way.)

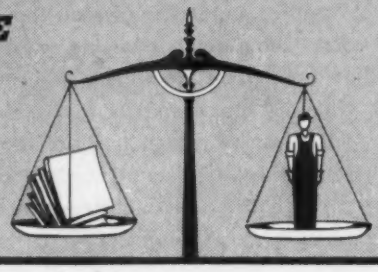
TOLERANCE—As much as the designer will concede and as much as the factory can endure.

Dachshund

RESEARCH is like a dachshund, whose nose sniffs tomorrow while his tail wags today.—*C. F. Kettering.*

Merit Rating

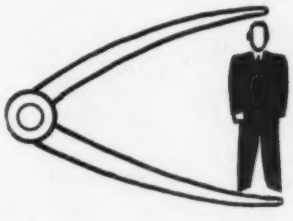
STRIKES A TRIAL BALANCE ON WORKER ASSETS



BY HARRY S. WHAREN

ASSOCIATE EDITOR

Measurement of worker qualities can be successful only with well-planned methods, installation and administration. If labor is as essential to production as is capital, then its contribution should be subjected to equally critical study and analysis. But to assume that merit rating can, like a vending machine, pop out undebatable answers at the press of a lever will lead only to grievances at every rating and grumbles on every pay day.



MEASUREMENT OF MAN

Merit rating plays a large role, either consciously or unconsciously on your part, in the personnel relations in your plant—whether or not you have a formal merit rating plan.

Everytime one of your supervisors decides a man is ready for upgrading, everytime a raise is given, everytime one man is laid off and another retained, everytime a supervisor helps an employee improve the standard of his work—merit rating takes its place as a management method.

The extent to which you have applied merit rating measures benefits to company and workers. The extent to which you have applied formal, systematic merit rating measures your effort to base judgment on complete information, to know your employees, to let them know where they stand in your opinion and to put employee relations on a sounder foundation.

Merit rating is not a substitute for job evaluation. It does not tell what an employee does in his job. It answers only the questions, "How well does he do it and what are his potentialities for a better job?" It is, aside from promotion, the best means of creating incentive for time-paid

employees. Merit rating puts man evaluation on the same factual basis that job evaluation gives to jobs.

Many organizations have, in the past ten years, dabbled in merit rating. Some have become dissatisfied with results or disgusted with union and employee objections and have discarded systematic rating. Other companies have ironed out weak spots of their plans and, recognizing the limitations, have made merit rating a workable tool. Companies that have successful plans realize that a plan must be aimed at particular objectives and limit its use to attaining those objectives. A plan established, for example, to indicate needed wage adjustments may be useless in determining the order of layoff. Complexity of plan should be governed by its purpose, management buying what it needs, not something that looks good on paper.

Merit rating, like job rating, tampers with a man's take-home pay and, as a result, must be sold if the plan is to be highly successful. As merit rating cannot, and should not, be kept secret, installation can well be preceded by discussion with union or employee representatives. It may even be desirable to have such representatives set in when the plan is developed, as they can often offer valuable suggestions that might later prevent misunderstandings.

Employees should be acquainted with the basic principles of merit rating, what the company hopes to do with it and how it benefits both management and labor. Employee handbooks, house organ, bulletin boards and personal letters have been used to give desirable publicity. Selling the program well in advance may obviate undesirable reaction and insure employee acceptance.

But successful merit rating goes beyond employee acceptance. It demands strong support from top management and complete understanding and cooperation from the supervisory force. Merit rating is a staff function, but performed by line supervisors. They must be convinced of its immediate use to them in handling and directing their men, getting out production and improving the quality of work.

Formation of an advisory or a rating review committee, as the first step in an installation, enlists executive support. This committee can formulate policy, approve procedures and review ratings. It can judge, if composed of men well acquainted with all jobs and plant conditions, what type of plan will best serve to solve specific production and personnel problems.

In developing a plan, management may call in a consultant or tailor-make its own. Both ways have their merits—and also their limitations. But before adopting a plan, management should not jump blindly, and keep on jumping from plan to plan, as there is no surer way to kill employee confidence.

The form should be made as simple as consistent with objectives of the plan and require as little "paper work" as possible. It should be easily understood and well adapted to discussion between supervisor and employee. adapted to discussion between supervisor and employee. But it should not be regarded as the "end" of the program, because without intelligent administration by trained raters the best of forms can do nothing but fail.

WHAT MERIT RATING CAN DO

1. *Assist management in eliminating unwarranted inequities in wage rates by providing a sound basis for adjustments according to abilities, capacities, performance and progress of employees.*

2. *Identify men eligible and worthy of promotion to higher rated or supervisory jobs.*

3. *Identify men whose ability or skill make them eligible for transfer to other jobs or departments.*

4. *Stimulate employee guidance and interest in self improvement. An employee's knowledge of his weaknesses and strengths leads to self analysis and development of personal traits and skills.*

5. *Provide means for determining justification for discharge or layoff. Even when layoff is governed by seniority rules in unionized plants, the contract may state that seniority applies where ability, skill and performance are equal.*

6. *Improve supervision by making supervisors think analytically about employees and consider means of guidance and correction.*

7. *Furnish a basis for appraising a new employee to determine his progress and whether he should be retained, transferred to other work or dismissed.*

8. *Assist supervisors in assigning work to employees because of a better knowledge of abilities, capacities and skills through stimulation of observation of actual performance and cooperation.*

9. *Provide greater consistency and fairness in handling and comparing employees, protecting them as much as possible against favoritism.*

10. *Develop morale and confidence in management, resulting in better employee relations and easier recruiting. Better workers go where they know their superior skill will be rewarded and where they will not be "lost in the shuffle" at a stagnant wage rate or held on one job by a supervisor.*

11. *Subject supervisors' opinions of employees to higher management for judgment on severity, leniency or fairness.*

12. *Act as good insurance against charges of discrimination, because permanent records are available to prove fair and equitable rating.*

Merit-Rating Methods

MERIT rating, like job evaluation, has grown from humble beginnings and still is suffering from growing pains. Although long recognized as a need in the field of management, no one plan has yet been developed that can be said to be truly successful in all organizations.

Some faults in merit rating stem from the fallacies on which some plans are based. Other faults are caused by managements trying to accomplish purposes for which their particular plans may not be suitable.

Of the merit-rating plans in use, some will serve best for certain purposes, whereas other plans are best for entirely different purposes. It is generally accepted that plans involving comparative ranking of employees are intended primarily for making wage adjustments, promotions, layoffs and transfers. But plans involving comparison of an employee's performance against predetermined performance standards are considered more useful and adaptable to employee improvement.

Recognition of these purposes and of the importance of adapting the plan to the specific needs of an organization has resulted in a wide variety of combinations of the few basic merit-rating methods. Some of these combinations have been good. Others have been drawn up with so little thought and have been so unsuccessful and unacceptable by labor that many companies have abandoned merit rating.

Man-to-Man Comparisons

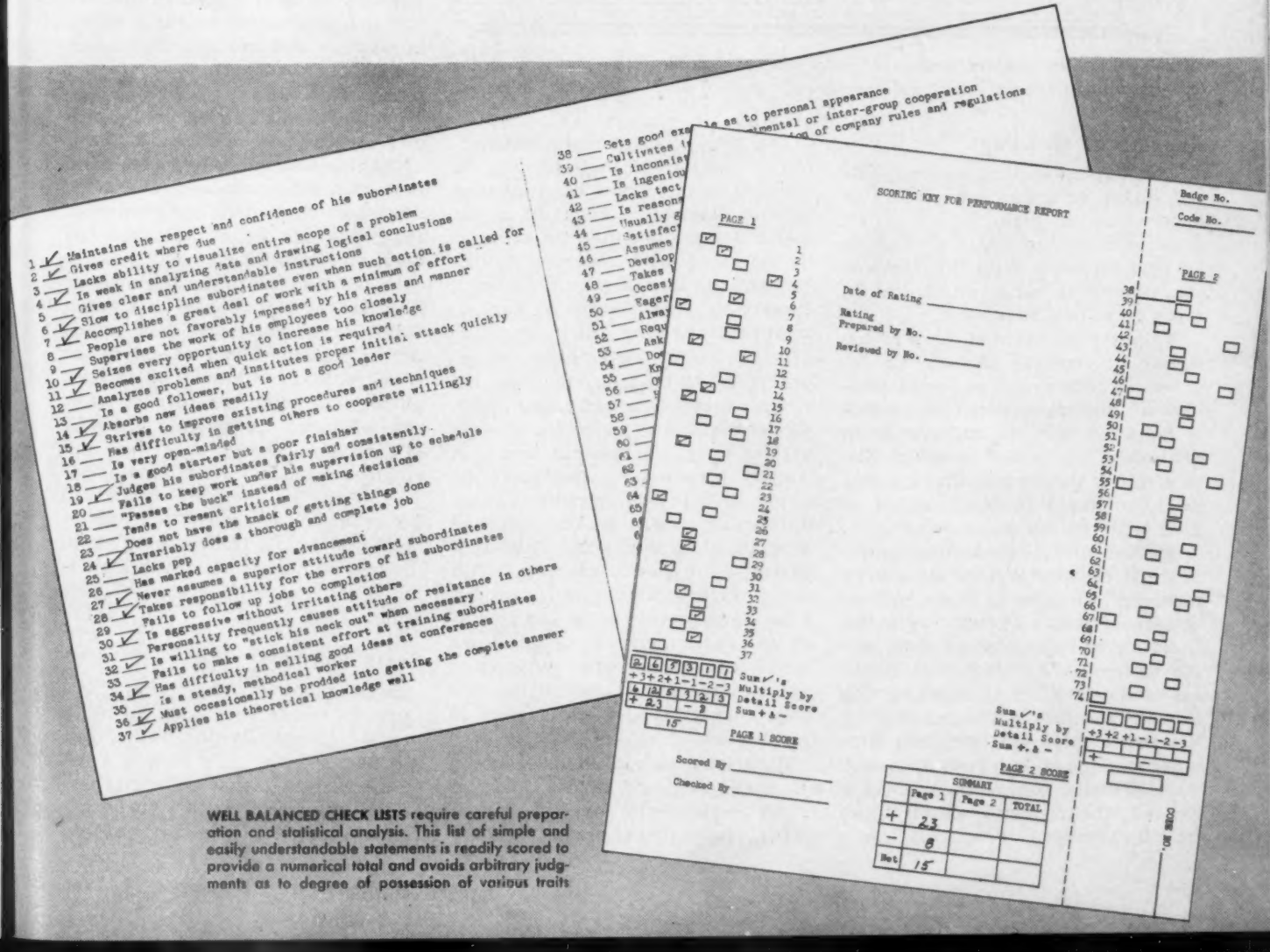
Modern merit rating dates from 1916 when the Bureau of Salesmanship Research was organized at Carnegie Institute of Technology to investigate the selection of salesmen. In 1917 a rating scale was developed to serve both as a guide in selecting new salesmen and as a measure of desirable traits of present salesmen.

As soon as World War I started, the scale was revised to meet the needs of the Army in rating officers and officer candidates, and became known as the Army rating scale.

The plan was based on five qualities, or traits: (1) physical qualities, (2) intelligence, (3) leadership, (4) personal qualities and (5) general value to the service. Each quality was defined and assigned five degrees, each of which was given a numerical value.

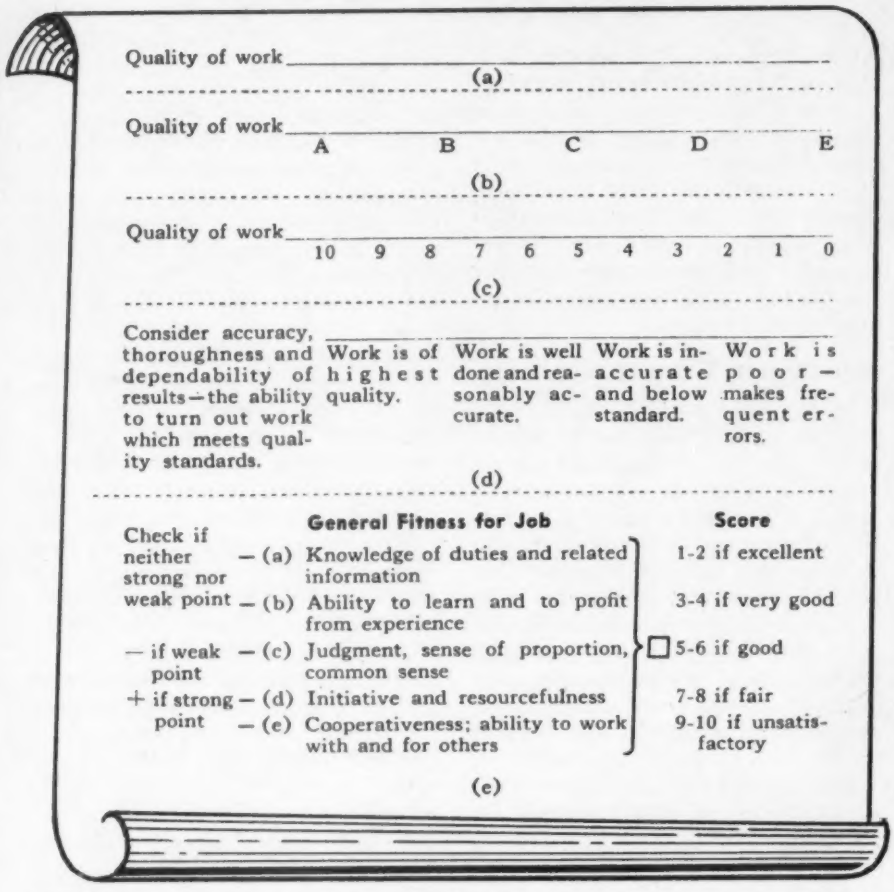
In using the scale, raters selected an officer to typify each degree of each quality. Each person rated was then compared with the five officers selected for each quality and given the point values of the officers he most closely resembled in the various degrees. Totaling the point values gave the composite score of each person.

This plan was subsequently adopted by some civilian organizations, but has since been discarded by practically all of them and also by the Army. It is cumbersome and requires too much time to select the men for the master rating scale. Selecting these men cannot be done accurately, as there is no basis for selection other than the rater's opinion. The man selected as highest in a particular quality by one rater might be equivalent to one selected for the middle position by another rater. Under these conditions, neither accurate results nor confidence by raters or persons rated can be expected.



WELL BALANCED CHECK LISTS require careful preparation and statistical analysis. This list of simple and easily understandable statements is readily scored to provide a numerical total and avoids arbitrary judgments as to degree of possession of various traits

VARIATIONS OF SCALE METHODS


Quality of work
(a)
Quality of work
A B C D E
(b)
Quality of work
10 9 8 7 6 5 4 3 2 1 0
(c)
Consider accuracy, thoroughness and dependability of results—the ability to turn out work which meets quality standards.
Work is of highest quality.
Work is well done and reasonably accurate.
Work is inaccurate and below standard.
Work is poor—makes frequent errors.
(d)
General Fitness for Job
Score
Check if neither strong nor weak point
— if weak point
+ if strong point
(a) Knowledge of duties and related information
(b) Ability to learn and to profit from experience
(c) Judgment, sense of proportion, common sense
(d) Initiative and resourcefulness
(e) Cooperativeness; ability to work with and for others
1-2 if excellent
3-4 if very good
5-6 if good
7-8 if fair
9-10 if unsatisfactory
(e)

VIEW (a)—plain graphic scale, (b)—alphabetical scale, (c)—numerical scale, (d)—descriptive scale and (e)—numerical scale with check-list features

Ranking or Grading

The simplest method of merit rating is the so-called rank-order, or order-of-merit, plan in which all employees are ranked, or graded, on an over-all basis. With this method, the supervisor ranks employees in order from best to poorest.

When the objective of merit rating is only to indicate the varying degrees of efficiency of employees, over-all ranking is satisfactory. But it is of no help to supervisors in analyzing job performance or distinguishing those traits that indicate need for employee improvement or good material for promotion.

Because of these limitations, order-of-merit ranking is more frequently made on a number of traits, such as quality of work, quantity of work, initiative and cooperation. Each employee is ranked in each trait. Ranking is repeated for all traits, giving as many results as traits and showing how each employee compares with other employees with respect to each trait. When a composite ranking is desired, the rankings on all traits may be averaged.

The major objection to order-of-merit ranking is the difficulty in rating a large number of employees by one supervisor. About 25 is the maximum number that can ordinarily be rated with accurate results. Rating more than 25 requires making excessively fine discriminations to arrange all in rank order.

Another objection is that no measure is made of the difference between employees in successive ranks. While the difference in the middle of the scale is probably small, it may be considerably greater at the upper and lower extremes. These differences cannot be distinguished as grades are considered to be separated by equal intervals. With order-of-merit ranking, it is also difficult for supervisors to justify ratings to employees. Comparisons made between persons rather than against established definitions are more intangible and less subject to justification.

A variation in ranking is grouping of employees into grades, each of which designates a level of skill or merit. Into these grades, usually three to seven in number, employees are placed according to their merit and, if further refinement is desired, are then ranked within each grade. In addition to the limitations of ranking, grouping has the added disadvantage of requiring supervisors to decide divisions between grades.

Check Lists

A check list, in its simplest form, is made up of a series of questions or statements concerning the employee's performance on a job. Rating is done by checking "yes" or "no" to indicate whether the question applies to the employee. The principal objection to this method is that most individuals deviate little from average in their abilities and a categorical affirmative or negative answer cannot fairly be given.

To avoid this limitation, the check list may consist of statements indicating varying degrees of work performance or possession of measurable qualities. The rater checks the statements that apply most closely to the individual rated. The check list then approaches the make-up and characteristics of the scale method.

The degree check list is little used, as construction of a good list is difficult and requires considerable experimentation and statistical analysis. Companies that wish to avoid the research necessary should not consider this method as a poor list will give equally poor results.

Used as a supplement to the main part of a rating form, a check list will show the rater's impression of the employee's outstanding work and personal characteristics and help to spot reasons for extremely low or high scores and to rate the rater. Advantages of check lists, when properly planned and executed, are ready comparisons between employees in different departments, ease of rating, provision of a basis of discussion between supervisor and employee, and minimum halo effect. The term "halo effect" applies to the tendency of a rater to grade an employee in all traits according to his over-all impression or his opinion of the employee in any one particular trait.

Scale Methods

Scale plans of merit rating are far more widely used than any other method. Essentially, the distinguishing feature of a scale plan is a list of different traits, usually three to fifteen in number. Each trait on the rating sheet is provided a scale on

which the rater indicates the degree to which the trait is exhibited by the employee being rated.

Many variations of the scale method exist, as scales may be constructed in graphic, alphabetical, numerical, percentile or descriptive forms. If each trait is divided into degrees, the plan is then known as a multiple step scale.

Graphic scales originated as a plain linear scale in which each trait is followed by a straight line without gradations. One end represents possession or display of the least amount of the trait and the other end the maximum amount. The rater simply checks each line at a point that expresses his opinion of the employee.

Use of this scale showed that the rater needed more guidance on which to base his rating. Accordingly, linear scales were modified by indicating variation by letter, number, percentage or a descriptive word, phrase or question. All these scales are based on the assumption that a rater can make a precise judgment on the employee's possession of a trait. As it is generally agreed that such fine distinctions in judging a trait are impractical, if not impossible, multiple - step scales were developed to eliminate this disadvantage.

Step scales, usually having from three to seven degrees, or steps, for each trait, is well illustrated by the National Metal Trades Association (NMTA) plan. It has six traits, or factors: quality of work, quantity of work, adaptability, job knowledge, dependability and attitude. After each factor are four questions to act as a yardstick against which the rater bases his judgment. Questions have been selected that tend to set up definite standards of performance.

Factor Weighting

The factors are rated on a numerical scale and weighted according to importance. Weighting is made by estimating what part of 100% should be apportioned to each factor. Quality of work is given 25%, quantity 20%, adaptability 15%, job knowledge 20%, dependability 10% and attitude 10%. Translating these percentages into points gives a total maximum score of 100 points. A further breakdown assigns decreasing values to following degrees. Quality of work, for example, is assigned 25, 23, 20, 18, 15, 13, 10 and 8 for the full range of degrees.

The total score given an employee slots him into one of five groups set up on a point range and graded as to wage rate. If job evaluation is in effect, the rating groups cover the spread of the rate range for the job. Group 5 members would receive base rate, and increases of 25% of the range would be made for each higher group, with group 1 members receiving top rate.

Advantages claimed for graphic rating scales are: (1) evaluation of a number of traits is easier to make than a single over-all evaluation; (2) trait definitions act as a yardstick for the rater; (3) degree of trait can be estimated accurately, depending on rater's knowledge of employee and freedom from bias or rating on a well-remembered single incident; (4) an individual worker can be rated, which is impossible with an order-of-merit plan; and (5) weighting traits and assigning degree points afford for each employee rated a total score directly comparable to those of other employees.

Disadvantages of Scale Rating

There is a growing belief that some aspects of scale rating are undesirable and do not achieve the objectives of merit rating. It is recognized that, no matter how carefully defined, trait and degree definitions will not mean the same to all raters. Moreover, the wider the range of jobs, the more variation there will be in interpretation and evaluation of performance against predetermined degree definitions. These objections illustrate the need for a trained and impartial review committee.

Weighting of traits and calculating numerical scores are also under question. J. Tiffin (A.M.A. Personnel Series No. 100) points out that weighting "is based on the assumption that the greater the number of maximum points, the more heavily the trait will be weighted. Actually, this assumption is in error because the weight of each trait is determined by the relative spread or variability of the ratings given to the employees on it. Thus, if the variability of ratings on any trait is small, that trait will have relatively little effect on the composite score, regardless of how large the theoretical maximum rating on the trait could be." On the other hand, some authorities feel that, where job evaluation is in operation, it is desirable to weight scales according to the values used in determining the job grade in the job-evaluation plan.

Don't Let the Halo Effect Upset Your Ratings

Total point scoring, according to some authorities, is also unjustified when used for comparison of employees. As merit rating cannot be made with any fine distinction, direct comparison of score for score and attaching too much importance to the numerical score can be dangerous to employee relations. To some extent, this difficulty may be avoided by grouping total scores as done in the NMTA plan. Decisions affecting company and employee welfare may warrant more exhaustive reratings, especially with borderline cases.

Some companies use no over-all score but only trait scores, either total or, preferably, grouped. Results are difficult to summarize, but superiority in any trait will not be concealed, which is possible with over-all scoring.

Other companies, believing it neither desirable nor possible to reduce judgment on employees to exact figures, refrain from any scoring. While the rating may be of value in employee improvement and may aid discussion between employee and supervisor, point scores are considered by most managements as more valuable in gaining additional benefits from merit rating.

How Valid is Merit Rating?

Whether a merit-rating plan is successful in fulfilling its purposes and whether employees and raters retain belief in it depend on its validity and reliability.

Validity (whether the plan measures what it is intended to measure) has been determined in practice by a number of methods. R. S. Driver ("The Validity and Reliability of Ratings," A.M.A. Personnel, vol. 17, No. 3) presented these as:

1. Comparison with direct measurements of performance.
2. Follow-up on ratings.
3. Determining presence of halo effect.
4. Comparison with psychological tests purporting to measure the same ability.

Does the Witch of Ignorance Shoot Your Employee Relations Full of Holes?

5. Comparison with work samples —short periods of performance under controlled conditions, the results of which can be measured.
6. Analysis of distribution of rating results.
7. Comparison of rater's opinions with those of one person considered very well informed.
8. Comparison of before and after ratings received by an employee transferred to another department.
9. Comparison of ratings of individuals considered outstanding with those of individuals considered inferior.

Of these methods, comparison with direct measurement of performance, in which co-variance of ratings and measure of performance is computed by statistical means, is most direct and useful when such direct performance measures are available. This usually is not the case, which makes such comparisons impractical.

Follow-Up Takes Time

Determining validity by a follow-up on ratings involves comparison of ratings with future progress of employees. This method not only requires considerable time—at least a year, but means that ratings cannot be used in the meantime. Moreover, it does not take into account possible employee improvement during that period. Despite these drawbacks, the method has been widely and satisfactorily used, as it is objective in character.

The so-called halo effect may affect validity, but proving the presence of the halo effect is extremely difficult, even by correlation. Its presence may be indicated by a high degree of uniformity of ratings on separate traits, but in most plans the traits are too few to indicate this accurately.

Halo effect, while probably always present to some extent, may be reduced by rating at one time all employees on each trait instead of rating an employee on all traits before proceeding to the next. Setting up the form so as not to have the desirable degree of all traits at the same end may also reduce halo effect, because the raters are forced to consider the definitions more closely. Moreover, it is desirable to train raters to recognize the tendency so they evaluate each trait individually without regard to others.

Determining validity by analysis of the distribution of rating results is based on the assumption that such distribution should take the shape of a normal curve. If this assumption is correct, validity can instantly be tested by a direct comparison of the distribution of the rating scores with the percentages normally expected to fall within established groups.

As a general rule, about 50% will fall into the average group, 25% above and 25% below. For ratings classed into five groups, theoretical percentages would be 4, 24, 44, 24 and 4. Actual percentages, however, seldom conform to theoretical percentages, as the distribution curve is usually found to be skewed toward the high end of the scale. Some authorities differ on this point, maintaining that distribution is normal if enough employees are rated, unless applied trait weights skew the curve.

But the skewed curve is to be expected, because careful employee selection, employee guidance and job-method work make the group more select and more likely to produce the required quantity of acceptable work. Furthermore, when employees that perform closely related work are few in number, the law of probability will not necessarily prevail as the sample is not large enough to be truly random.

Besides halo effect, raters may influence validity by rating most employees average rather than in their proper degree. This tendency is readily observable and can be controlled by varying definitions on the form, using an even number of degrees for each trait and training raters to avoid it. Another tendency that should be guarded against is leniency of raters, who often hesitate to rate an employee in a low degree even when that is the correct and justified rating.

Plans Should be Reliable

The reliability of a merit-rating plan determines whether the plan measures consistently what it is intended to measure. If a plan does not give the same results in subsequent reratings as obtained the first time, distrust in the plan soon obviates any possible benefits.

In contrast to validity, reliability can be determined easily by statistical means. One method, termed the test-retest method, compares by correlation the ratings completed at one time with those completed at the end of a stated interval. Another method is to compare ratings made by a number of raters who have, as nearly as possible, the same knowledge of the employees being rated. Still a third method is to compare how ratings on half the traits agree with ratings on the other half.

None of these methods, as in the case of validity, give absolute assurance that a plan is reliable. Rating is a matter of judgment and should be considered so, rather than as an exact measurement of performance or capacity.

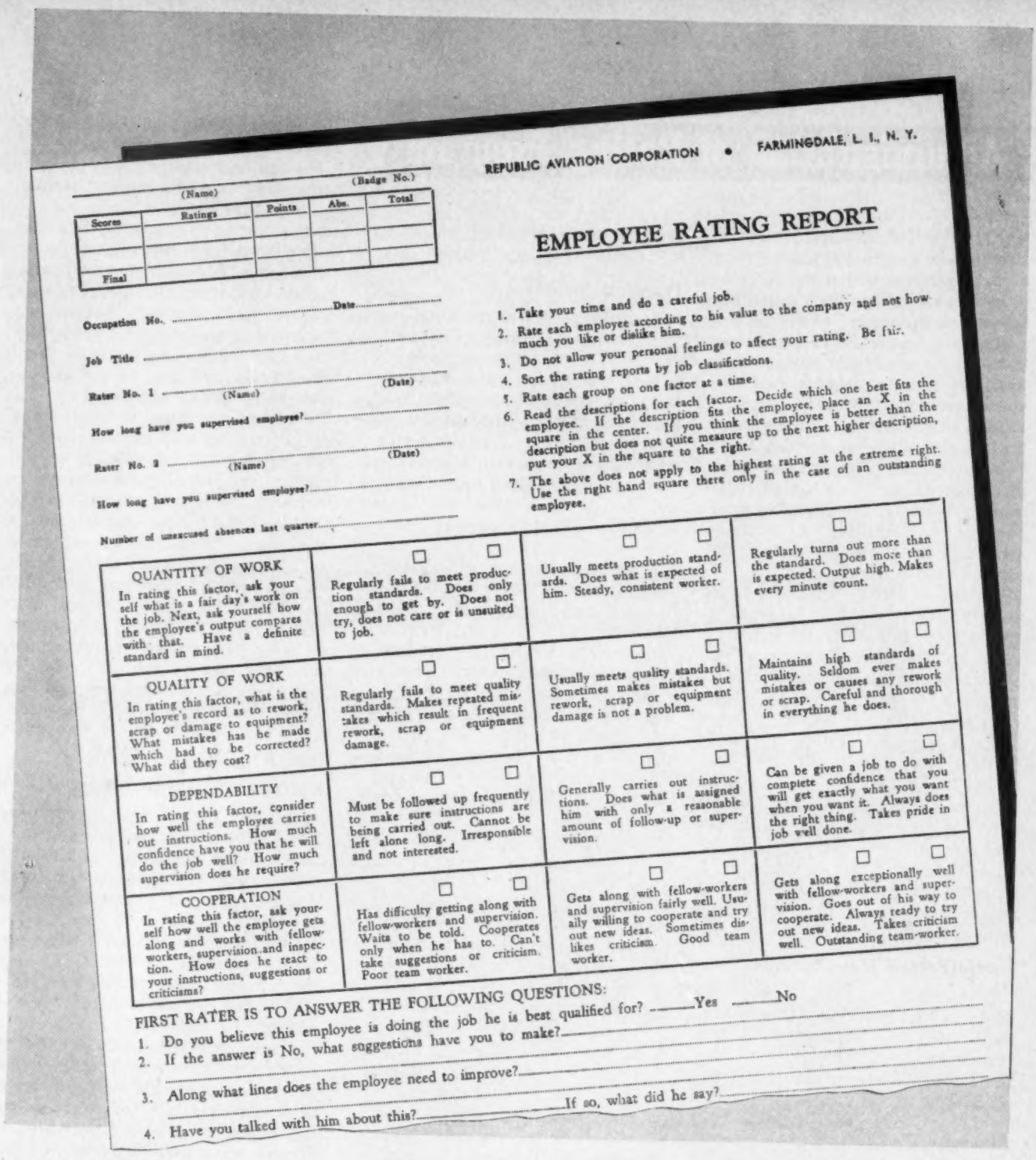
Selection of Traits

Both validity and reliability of a merit-rating plan are affected by selection and definition of traits. Employees should be evaluated, for example, on traits that they can exhibit in the work actually performed. These traits may be objective or subjective in character. Even a trait, such as quantity of work, may be objective and directly measurable on one job, while on another job it may not be measurable and therefore subjective.

The extent to which objective traits should be rated is open to question. Some authorities maintain that only ratings on objective traits give the true evaluation of an employee, whereas others claim that no objective traits should be included if the information is available from records. Inclusion of such traits, however, affords a means of measuring the validity of ratings on subjective traits.

The principal factors that govern selection of traits are objectives of the plan and type of work. If the plan, for instance, is to be used as a basis for layoff, then length of service and number of dependents might be considered, although these do not affect the employee's performance on the job. On the other hand, their use would be senseless if the primary objective of the plan were selection for promotion.

Type of work affects trait selection in that employees working on various types of jobs cannot be evaluated on the same traits. Rating a turret-lathe operator on vision of achievement or a research engineer



REPUBLIC AVIATION CORPORATION • FARMINGDALE, L. I., N. Y.

EMPLOYEE RATING REPORT

(Name) (Badge No.)

Scores	Ratings	Points	Abs.	Total
Final				

Occupation No. ..... Date .....

Job Title .....

Rater No. 1 ..... (Name) (Date)

How long have you supervised employee? .....

Rater No. 2 ..... (Name) (Date)

How long have you supervised employee? .....

Number of unexcused absences last quarter .....

1. Take your time and do a careful job.
2. Rate each employee according to his value to the company and not how much you like or dislike him.
3. Do not allow your personal feelings to affect your rating. Be fair.
4. Sort the rating reports by job classifications.
5. Rate each group on one factor at a time.
6. Read the descriptions for each factor. Decide which one best fits the employee. If the description fits the employee, place an X in the square in the center. If you think the employee is better than the description but does not quite measure up to the next higher description, put your X in the square to the right.
7. The above does not apply to the highest rating at the extreme right. Use the right hand square there only in the case of an outstanding employee.

QUANTITY OF WORK In rating this factor, ask yourself what is a fair day's work on the job. Next, ask yourself how the employee's output compares with that. Have a definite standard in mind.	☐ ☐ Regularly fails to meet production standards. Does only enough to get by. Does not try, does not care or is unsuited to job.	☐ ☐ Usually meets production standards. Does what is expected of him. Steady, consistent worker.	☐ ☐ Regularly turns out more than the standard. Does more than is expected. Output high. Makes every minute count.
QUALITY OF WORK In rating this factor, what is the employee's record as to rework, scrap or damage to equipment? What mistakes has he made which had to be corrected? What did they cost?	☐ ☐ Regularly fails to meet quality standards. Makes repeated mistakes which result in frequent rework, scrap or equipment damage.	☐ ☐ Usually meets quality standards. Sometimes makes mistakes but rework, scrap or equipment damage is not a problem.	☐ ☐ Maintains high standards of quality. Seldom ever makes mistakes or causes any rework or scrap. Careful and thorough in everything he does.
DEPENDABILITY In rating this factor, consider how well the employee carries out instructions. How much confidence have you that he will do the job well? How much supervision does he require?	☐ ☐ Must be followed up frequently to make sure instructions are being carried out. Cannot be left alone long. Irresponsible and not interested.	☐ ☐ Generally carries out instructions. Does what is assigned him with only a reasonable amount of follow-up or supervision.	☐ ☐ Can be given a job to do with complete confidence that you will get exactly what you want when you want it. Always does the right thing. Takes pride in job well done.
COOPERATION In rating this factor, ask yourself how well the employee gets along and works with fellow-workers, supervision and inspection. How does he react to your instructions, suggestions or criticisms?	☐ ☐ Has difficulty getting along with fellow-workers and supervision. Waits to be told. Cooperates only when he has to. Can't take suggestions or criticism. Poor team worker.	☐ ☐ Gets along with fellow-workers and supervision fairly well. Usually willing to cooperate and try out new ideas. Sometimes dislikes criticism. Good team worker.	☐ ☐ Gets along exceptionally well with fellow-workers and supervision. Goes out of his way to cooperate. Always ready to try out new ideas. Takes criticism well. Outstanding team-worker.

FIRST RATER IS TO ANSWER THE FOLLOWING QUESTIONS:

1. Do you believe this employee is doing the job he is best qualified for? ____Yes ____No
2. If the answer is No, what suggestions have you to make? .....
3. Along what lines does the employee need to improve? .....
4. Have you talked with him about this? ..... If so, what did he say? .....

THE WEIGHTED-POINT SCALE of Republic Aviation Corp. is similar to the NMTA plan in having two graduations for each degree. Point values range from 10 to 30 (10-14-18-22-26-30) for the first two factors and from 5 to 20 (5-8-11-14-17-20) for dependability and cooperation. Total score slots an employee into one of five groups or wage bands

on punctuality would be pointless. Any plan, therefore, that is to cover a wide range of jobs should be varied according to levels of skill or responsibility.

To enable the rater to make as accurate a judgment as possible, traits or factors should not overlap in their meanings. Moreover, definitions of traits and degrees should be made as objective as possible. Instead of setting up degrees for a trait, simply as excellent, good, fair or poor, it is better to define each degree by phrases or preferably by sentences or paragraphs. Cooperation could be expressed as "consider his attitude toward his work, company and associates and his willingness to work with and for others." Degrees could then be: does not cooperate, shows reluctance to cooperate, acceptable, gets along well with associates, and goes out of the way to cooperate.

The number of traits or factors depend to a large extent on the level of skill being rated, more being needed to evaluate executives than sweepers. The National Industrial Conference Board in report No. 39, "Employee Rating," recommends that no more than twelve be included, as raters are liable to become impatient and careless with a greater number. Most forms have about seven, while some authorities recommend use of even less, as few as two, such as job performance and promotability. Although rating on so few traits may measure an employee with great reliability as far as worth to the company is concerned, selling such a plan to raters and management may be difficult.

Administration of Rating Program

WHATEVER method may be selected, whatever type of form may be developed — a merit-rating program is, from the beginning, doomed to failure or, at the best, to mediocre success if it is administered badly. But a good plan, administered well, can provide benefits that only merit rating can give.

Good administration depends on fair ratings made at regular intervals by trained raters, reviewed by management, used as a basis for discussion between employee and supervisor, and utilized by management and the personnel department for intended purposes.

Ratings, as already mentioned, are usually made by line supervisors, although rating may be considered a personnel function. As such, a representative of the personnel department may cooperate with a supervisor in making the ratings or even make a separate rating if he is familiar with the employees being rated. The supervisor, especially in large organizations, is usually the only one who knows his employees well enough and has an intimate knowledge of their work over a long-enough period to make fair and equitable ratings. Higher supervisors seldom know the men this well.

Participation May Backfire

In some companies, ratings are made by the supervisor in conjunction with the employees. Certain advantages—self-analysis, with corresponding self-improvement and confidence in the plan—may result from employee participation, but these advantages may "backfire" if ratings are subsequently reviewed and down-graded. Moreover, many companies consider merit rating strictly a management function and, as such, not a subject for employee participation. In at least one company, however, joint rating by supervisor and department union steward has worked out extremely well in improving employee cooperation and gaining confidence in the plan.

Rating may also be done by a committee of supervisors, at least one of whom should know intimately the employee and his work. But operation of a committee should not replace the immediate supervisor as a rater, because the latter should always be regarded by his workers as responsible for their welfare as well as that of the company.

Training Raters

Regardless of who or how many may rate each employee, all rating can well be done in conference or at least under supervision to prevent hasty, unfounded evaluations. Training of raters can eliminate this common trouble, as well as many others encountered by inexperienced raters. A man may be a good supervisor but not necessarily a good rater unless he has been taught how and how not to rate.

If a supervisor has cooperated in development of the plan, comparatively little additional training may be needed. But, in larger companies, all supervisors cannot be brought in on the establishing of the plan and should be trained on the purposes and uses of merit rating, psychological aspects of human abilities, mechanics of the plan, supervisor-employee interviews and problems encountered that may produce errors in evaluation.

Training may be done in conference, individually or by manual. Most organizations recognize that instruction by personal contact gives better results than reliance on printed material only. Group training usually covers all phases of merit rating and is amplified by practice ratings. Individual instruction may be advisable in some instances, but is so time consuming that it is not practicable where many raters are to be trained. Printed material, such as manuals, can well complement personal contact training. Manuals should be given careful thought and preparation to make sure that the subject is presented clearly, simply and with few ambiguities.

Whatever training method, or combination of methods, may be used, raters should be particularly acquainted with halo effect and the tendency to rate too many employees as average. These may introduce errors that affect the validity and reliability of ratings. Raters should be urged to rate on facts wherever available, rather than on opinion alone, and to use the whole range of degrees on each trait. This last can be forced on raters by requiring a forced distribution, such as an allocation of employees rated into percentage bands of 10-20-40-20-10, on the assumption that the normal curve gives accurate rating.

No set time interval can be recommended as giving the best results. Some companies rate only once a year, whereas others may rate every 3 or 4 mos. The interval should be definitely not over a year and preferably less, especially when ratings govern merit increases. Ratings too frequently, however, show too little change in employees to make them worthwhile and also load unnecessary work on the supervisors.

All employees may be rated at one time, or rating may be staggered by departments, alphabetically or according to employment anniversaries. Staggering of ratings may be less burdensome to raters, but is more likely to result in less-accurate evaluations. Rating an employee on all traits at one time, as generally followed in staggered rating, may lead to more halo effect than rating all employees on each trait in turn. As either method can give good results, selection depends primarily on preference of management or agreement with the union if the union contract covers this point.

Rating Review and Appeal

To offset poor ratings and to control uniformity of ratings throughout a plant, most companies have each rating reviewed, either by a line executive or a member of the personnel department. In some plants the reviewer may change the rating, whereas in others he may indicate his disagreement or discuss it with the rater to iron out discrepancies. The last practice is strongly recommended if supervisors are to retain confidence and interest in the program. Undermining the authority of a supervisor, whether done by higher executive or a representative of the personnel department, can only result in a weak, disorganized company structure.

But if a supervisor, from personal bias or ignorance, rates unfairly, the reviewer is justified in demanding a change, as otherwise it may lead to a grievance from the employee. When take-home pay, promotion, discharge or layoff is affected by a rating, the employee has justifiable cause for an appeal. When a plan has been accepted by union or employees, there should be no right of appeal on the plan as a whole, but only on the individual rating. Such a grievance should receive the same consideration as any other, and be handled by regular grievance procedure.

In many companies, it is felt that grievances on ratings can be headed off by informal discussions between supervisor and employee. Whether an interview is desirable is possibly the most debatable point in merit rating. A friendly discussion, provided that it is handled right, can do much to lead to teamwork within a department and to employee development through knowledge of his weaknesses and guidance by his supervisor. But a clumsy interview can lead to antagonism of the employee and loss of confidence in the program.

If the supervisor does not handle the interview with tact and is unable to explain simply the working of the plan and why a particular rating was made, it is highly unlikely that any benefit can come from the discussion. For this reason, training of raters in conducting interviews is as important as training them to fill out the forms correctly. A cardinal rule for a supervisor is never to conduct an interview without adequate preparation for it. He should know what he is going to say and how he is going to say it. Even a tactful supervisor can find it difficult to tell an employee that he does not measure up to standards and to tell it so the employee will leave the office with his self-respect and determination to improve, not with a bad grouch.

After planning the interview, the supervisor should conduct it in private. By first explaining the plan and purpose of the interview, he can put the employee at ease before discussing personal factors. Then presenting strong points before discussing the employee's weaknesses can do much to making the bitter taste sweet. But mentioning weaknesses with no suggestions for improvement is neither constructive nor advisable. Concluding the interview with a summary placing emphasis on the employee's strong points and means of self-improvement lends purpose to the rating plan.

Merit Rating in Metalworking Plants

THESE ARE TYPICAL merit-rating plans proved successful in a variety of different plants. Although direct adoption of any one plan might prove inadvisable for another plant, knowledge of successful plans can indicate means of attaining objectives.

Air Associates, Inc. Emphasizes Union Participation

Merit rating and job evaluation was installed during the war in an effort to improve labor relations and increase production of badly needed aircraft parts. Merit rating was made a joint program, calling for participation by representatives of the local union (U.A.W., C.I.O.) and semi-annual rating of each employee by his immediate supervisor and the department steward.

The plan is a weighted-point scale with a maximum score of 100 points. Employees are rated on quality of work, quantity of work, adaptability, job knowledge, dependability and attitude. Four degrees, each with two gradations, are defined for each trait.

When ratings made separately by foreman and steward differ by more than 10 points, the case is referred to a joint committee composed of three representatives of management and three of labor. Should the committee fail to reach an agreement, it is referred to the president of the company for final decision.

The payoff of the plan, which was intended for wage adjustments, transfers and promotions, is an all-time high in worker morale. Confidence in the plan has been sustained by its proved validity and reliability, and by employee conviction that union participation insures fair and honest appraisal without taint of favoritism.

The company has found that union participation has developed responsibility in the union representatives. The possibility of facing one or more irate constituents who feel they were unfairly rated and so received no merit increase, while co-workers did, makes stewards certain that their appraisals can be defended and justified with facts and figures. When foreman and steward agree on a higher rating, the employee invariably is deserving of the merit increase.

Daystrom Corp. Div. Stresses Supervisor-Employee Interview

Merit rating, or performance review, was installed at Daystrom (American Type Founders, Inc.) primarily as a basis for ingrade merit increases and employee improvement and morale, and secondarily as a guide for promotion and transfer. Company policy is stated as, "Reviewing the work of employees and assessing the relative value of each person's performance is a major responsibility of the supervisor. Only by reviewing and evaluating each person's work, with care and fairness, can the supervisor develop a desirable spirit of teamwork."

The plan is a weighted numerical scale covering quantity, quality, care of equipment, dependability, cooperation and flexibility. Eleven degrees are established for each trait and valued in arithmetical progression from 0 to 200 points for the first two traits and 0 to 100 for the others. The sixth degree is regarded as "normal expectancy," based on the supervisor's standard of performance to be reached by an employee to qualify as a "normal" worker.

Ratings are made every 4 mos. of all employees who have been on their jobs for 30 days prior to the date of review. Evaluation is done by the immediate supervisor, preferably with the help of one or more other supervisors acquainted with the individual's work. Guide questions for each trait are furnished the supervisors.

It is believed at Daystrom that supervisor-employee discussion of each rating is of extreme importance to morale and employee self-improvement. To get maximum benefit from the interview, it is made in private and at a time when the employee is not rushed. The supervisor is cautioned to know the employee's strong points and weaknesses, and what he is going to say to the employee. Any question on the plan or doubt as to its use is first answered.

Experience has shown that, at this point, it is well to discuss the department in general and the employee's place in the department. This naturally leads the supervisor

to praise the worker's strong points and point out his weaknesses with definite suggestions for improvement. Management at Daystrom believes that unless a supervisor knows how an employee can improve, he cannot expect the employee to show improvement. Concluding with emphasis on abilities and any transfer, promotion or increase retains employee confidence in the program.

Inland Manufacturing Div. Rates Supervisors on Percentage Scale

Merit rating for supervisory employees at Inland (General Motors Corp.) has demonstrated a number of benefits, both for top management and for the supervisory force.

The plan measures on a percentage scale the degree of efficiency of each supervisor according to ten qualifications for his present job, classifies his promotional possibilities and shows any categories in which further improvement of the individual is needed for his present job or for promotion.

Ratings are made at 6-month intervals. In addition to the reports being studied by top management, each supervisor is allowed to see a copy of his own rating and recommendations for increase or promotion.

Principal benefits of the system of Inland are:

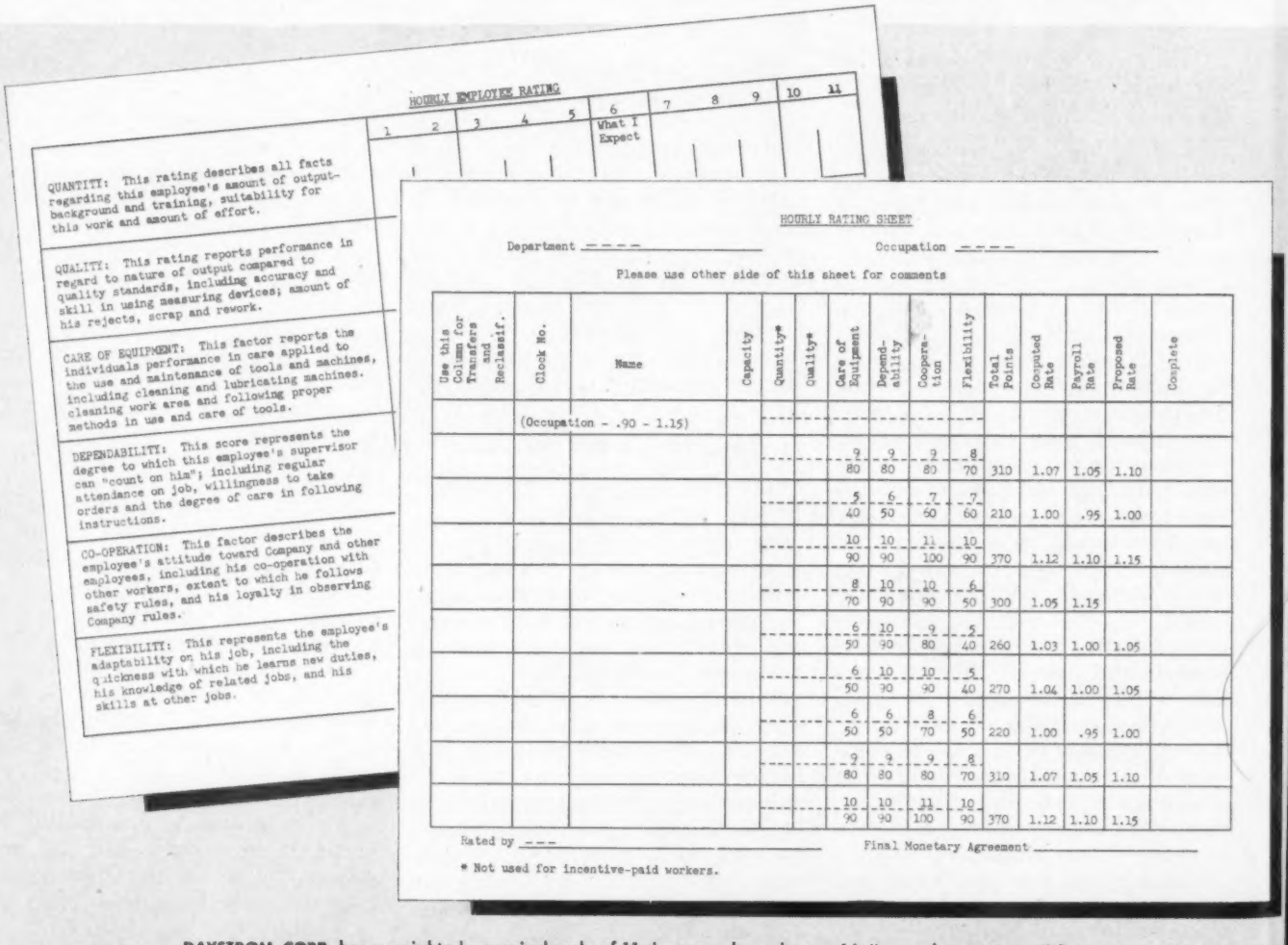
1. It provides top management with an accurate measurement of the ability of each supervisor in his present job, thus indicating where supervision is good and also where improvement is needed.
2. It provides the individual supervisor with the same accurate measurement of his own strengths and weaknesses, and shows him the direction in which he will benefit most from efforts for self-improvement.
3. It shows the individual supervisor that his virtues have been observed by top management, as well as his faults, and gives him added confidence in top management's fair dealing.
4. It weeds out incompetent supervisors, lifts the standards of those who remain, and improves the response of other employees below the supervisory level.
5. It produces a superior group of supervisors for further promotion and is reliable guide to top management in making such choice.

Lincoln Electric Co. Evaluates Workers for Promotion

This company believes, and acts on the belief, that failure to use the abilities of all employees to the fullest or to help develop their latent talents is one of the most costly failures any industrial organization can suffer.

One thing is impressed on all new employees: that any promotion they receive will come not as a result of seniority, but entirely because of ability. With this point of view, it is necessary that management give every person in the organization an opportunity to develop to the limit of his ability. All individuals must be watched carefully so outstanding performance is immediately recognized and rewarded.

The merit plan is a point-rating system with a maximum of 1,000 points. Every person in the factory is rated by the department head and his assistant every 6 months. The rating is transferred from the work sheet to a visual file card. A sliding orange tab on the card shows at a glance the rating of the individual, and as cards are filed by department, it also shows which employees in each department are the highest rated



HOURLY EMPLOYEE RATING

1	2	3	4	5	6	7	8	9	10	11
					What I Expect					

QUANTITY: This rating describes all facts regarding this employee's amount of output-background and training, suitability for this work and amount of effort.

QUALITY: This rating reports performance in regard to nature of output compared to quality standards, including accuracy and skill in using measuring devices; amount of his rejects, scrap and rework.

CARE OF EQUIPMENT: This factor reports the individuals performance in care applied to the use and maintenance of tools and machines, including cleaning and lubricating machines, cleaning work area and following proper methods in use and care of tools.

DEPENDABILITY: This score represents the degree to which this employee's supervisor can "count on him"; including regular attendance on job, willingness to take orders and the degree of care in following instructions.

CO-OPERATION: This factor describes the employee's attitude toward Company and other employees, including his co-operation with other workers, extent to which he follows safety rules, and his loyalty in observing Company rules.

FLEXIBILITY: This represents the employee's adaptability on his job, including the quickness with which he learns new duties, his knowledge of related jobs, and his skills at other jobs.

HOURLY RATING SHEET

Department ____ Occupation ____

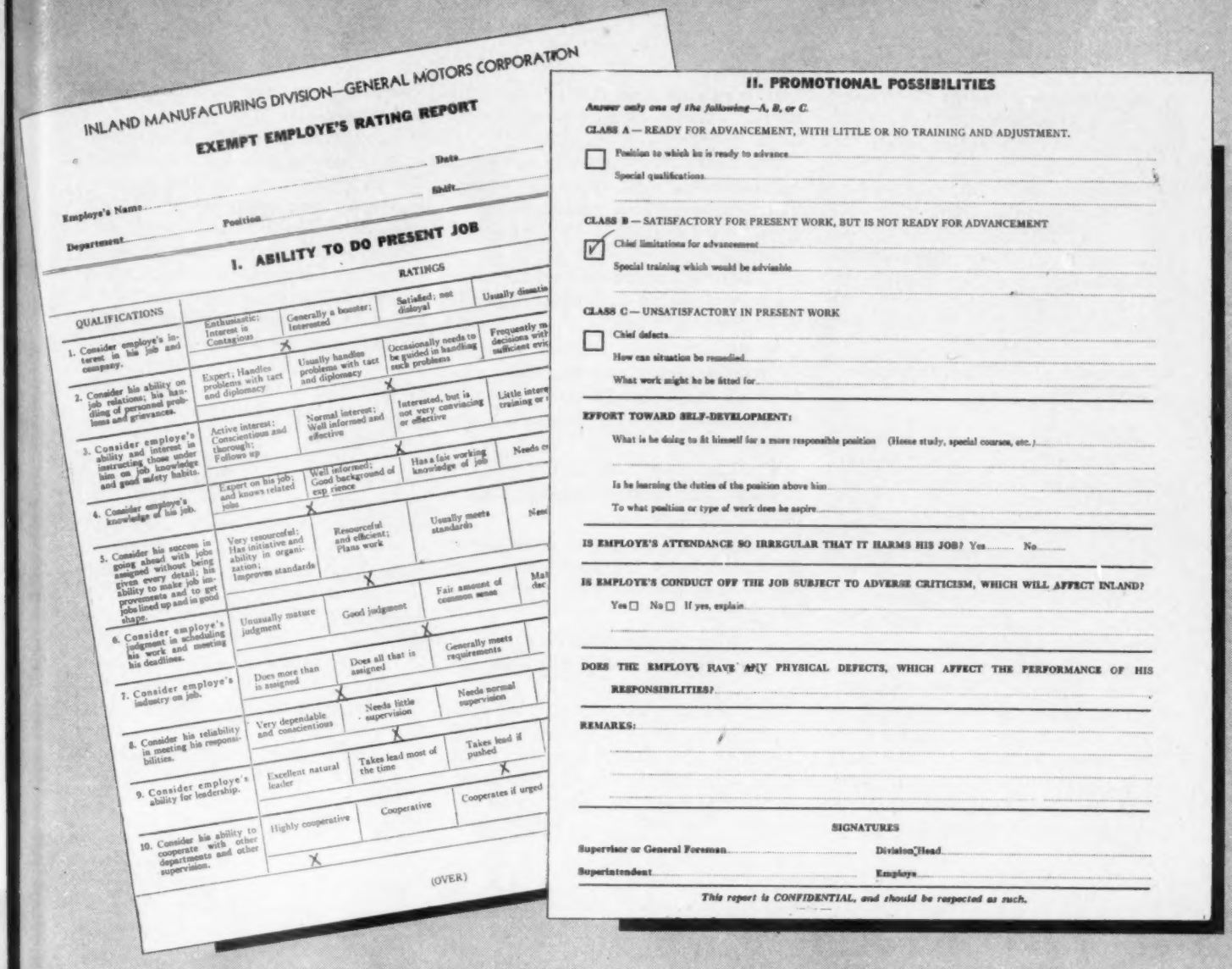
Please use other side of this sheet for comments

Use this Column for Transfers and Reclassif.	Clock No.	Name	Capacity	Quantity*	Quality*	Care of Equipment	Depend-ability	Coopera-tion	Flexibility	Total Points	Computed Rate	Payroll Rate	Proposed Rate	Complete
	(Occupation - .90 - 1.15)													
						9/80	9/80	9/80	8/70	310	1.07	1.05	1.10	
						5/40	6/50	7/60	7/60	210	1.00	.95	1.00	
						10/90	10/90	11/100	10/90	370	1.12	1.10	1.15	
						8/70	10/90	10/90	6/50	300	1.05	1.15		
						6/50	10/90	9/80	5/40	260	1.03	1.00	1.05	
						6/50	10/90	10/90	5/40	270	1.04	1.00	1.05	
						6/50	6/50	8/70	6/50	220	1.00	.95	1.00	
						9/80	9/80	9/80	8/70	310	1.07	1.05	1.10	
						10/90	10/90	11/100	10/90	370	1.12	1.10	1.15	

Rated by ____ Final Monetary Agreement ____

* Not used for incentive-paid workers.

DAYSTROM CORP. has a weighted numerical scale of 11 degrees where degree 6 is "normal expectancy." Summary by department and occupation shows rating scores and computed, payroll and proposed wage rates



INLAND MANUFACTURING DIVISION—GENERAL MOTORS CORPORATION

EXEMPT EMPLOYE'S RATING REPORT

Employe's Name ..... Date .....

Department ..... Position ..... Shift .....

I. ABILITY TO DO PRESENT JOB

QUALIFICATIONS	RATINGS			
1. Consider employe's interest in his job and company.	Enthusiastic; Interest is Contagious	Generally a booster; Interested	Satisfied; not disloyal	Usually dissatis
2. Consider his ability on job relations; his handling of personnel problems and grievances.	Expert; Handles problems with tact and diplomacy	Usually handles problems with tact and diplomacy	Occasionally needs to be guided in handling such problems	Frequently m decisions with sufficient evid
3. Consider employe's ability and interest in instructing those under him on job knowledge and good safety habits.	Active interest; Conscientious and thorough; Follows up	Normal interest; Well informed and effective	Interested, but is not very convincing or effective	Little intere training or
4. Consider employe's knowledge of his job.	Expert on his job; and knows related jobs	Well informed; Good background of experience	Has a fair working knowledge of job	Needs c
5. Consider his success in going ahead with jobs assigned without being given every detail; his ability to make job improvements and to get jobs lined up and in good shape.	Very resourceful; Has initiative and ability in organization; Improves standards	Resourceful and efficient; Plans work	Usually meets standards	Nee
6. Consider employe's judgment in scheduling his work and meeting his deadlines.	Unusually mature judgment	Good judgment	Fair amount of common sense	Ma dec
7. Consider employe's industry on job.	Does more than is assigned	Does all that is assigned	Generally meets requirements	
8. Consider his reliability in meeting his responsibilities.	Very dependable and conscientious	Needs little supervision	Needs normal supervision	
9. Consider employe's ability for leadership.	Excellent natural leader	Takes lead most of the time	Takes lead if pushed	
10. Consider his ability to cooperate with other departments and other supervision.	Highly cooperative	Cooperative	Cooperates if urged	

(OVER)

II. PROMOTIONAL POSSIBILITIES

Answer only one of the following—A, B, or C.

CLASS A — READY FOR ADVANCEMENT, WITH LITTLE OR NO TRAINING AND ADJUSTMENT.

☐ Position to which he is ready to advance .....

Special qualifications .....

CLASS B — SATISFACTORY FOR PRESENT WORK, BUT IS NOT READY FOR ADVANCEMENT

☑ Chief limitations for advancement .....

Special training which would be advisable .....

CLASS C — UNSATISFACTORY IN PRESENT WORK

☐ Chief defects .....

How can situation be remedied .....

What work might he be fitted for .....

EFFORT TOWARD SELF-DEVELOPMENT:

What is he doing to fit himself for a more responsible position (Home study, special courses, etc.) .....

Is he learning the duties of the position above him .....

To what position or type of work does he aspire .....

IS EMPLOYE'S ATTENDANCE SO IRREGULAR THAT IT HARMS HIS JOB? Yes ..... No .....

IS EMPLOYE'S CONDUCT OFF THE JOB SUBJECT TO ADVERSE CRITICISM, WHICH WILL AFFECT INLAND?

Yes ☐ No ☐ If yes, explain .....

DOES THE EMPLOYE HAVE ANY PHYSICAL DEFECTS, WHICH AFFECT THE PERFORMANCE OF HIS RESPONSIBILITIES? .....

REMARKS: .....

SIGNATURES

Supervisor or General Foreman ..... Division Head .....

Superintendent ..... Employe .....

This report is CONFIDENTIAL, and should be respected as such.

AN UNWEIGHTED GRAPHIC SCALE at Inland Mfg. Div. has a percentile scoring key for each trait, ranging from 1 to 10%. Rating on promotional possibilities, treated separately from present-job rating, requires comment and scoring. Final score, as 808, combines both ratings.

when a promotion may be made.

Obviously, this record is of little value unless it is used constantly. A regular promotion committee consisting of the general superintendent, personnel director, chief inspector, and the heads of the cost-reduction and production-control departments, meets every 6 weeks for the purpose of comparing and evaluating the ten top employees in the factory.

As a result of the 6-week evaluation, the ten top employees are moved from department to department, not necessarily as promotions but as means to determine how they will respond to new environment. When the promotion committee is convinced that a man is potentially a good supervisor, a program designed to bolster his weak spots and prepare him for more responsibility is then devised.

With this system, it is impossible for an individual who is of outstanding value to a particular department to be buried in that department by the supervisor. The promotion committee votes on the moves that are to be made on any individual, making it impossible for a single department head to hold a good man back.

Republic Aviation Corp. Rates on Absenteeism

The employee-rating plan, conducted by the industrial-relations department, contains four different factors: quantity of work, quality of work, dependability and cooperation. Each of the factors progresses from the lowest degree of the trait to the highest degree of the trait, and is divided into six gradations explained by descriptive statements. As all factors regarding each individual appear on this one form, it acts as a complete yardstick of the individual and may be compared easily with other employee reports.

The factors are scored in points, 30 points being given to the first two factors and 20 points to the last two for a maximum score of 100. From the employee's total score on the four factors, three points are deducted for each unexcused absence during the 3 months preceding the date of the rating. As numerical values may give the impression of a degree of accuracy that is not justified by the rating, the final numerical score is translated into categories symbolized by A, B, C, D and E.

All hourly paid employees are rated separately every 3 months by their first- and second-line supervisors. When differences in rating occur, they are reconciled at a meeting between the two raters to provide a single composite score.

The greatest value to be derived from a rating plan comes from the discussion of the rating with the employee. Thus, in a practical way a rating program is useful in making wage adjustments, developing and training employees, improving supervision and making promotions and transfers. The rating program, however, is not a substitute for job evaluation.

Unnamed Engine Manufacturer Develops Check List

Just as this company would not contemplate operating without precise knowledge of the functions and capacities of plant equipment, it was felt that equivalent information on personnel is equally indispensable in deriving maximum utility from human assets of the organization. To get this information, the check-list method was selected as best suited to company needs.

Steps taken in developing the check list show the care and analysis necessary to obtain a workable form. These were: compile a preliminary list of statements, grade the statements in this list, determine statements on which supervisors agree, and construct the check list with proper balance as to characteristics to be judged.

The preliminary list was compiled by requesting each of several supervisors to submit 20 or more statements conforming to the following rules:

1. Should relate to actual performance and be expressed in usual departmental terms.
2. Should cover various characteristics, ranging from those descriptive of very good to very poor employees, including those who are average.
3. Short and to the point.
4. No double meanings, and each cover only one point.
5. Each statement must mean something as to the extent to which the employee concerned is or is not satisfactory.
6. Must be such that they can be checked as applying or not applying to a given employee.

The preliminary list was scanned carefully to remove duplicate statements or ones not conforming to the rules, and divided into groups of 78 statements, each balanced as to supervisory ability, job performance, mentality, capacity for advancement and personality.

Statements in each group were graded individually by a large number of supervisors on the basis of where an employee would be on a scale of 1 (exceptionally poor) to 9 (exceptionally good). This permitted selecting of statements given approximately the same grade by the supervisors and applying relative weights. Extent of agreement was computed statistically (semi - interquartile range), and statements showing poor agreement were eliminated.

Remaining statements were arranged in grades from those most favorable to those least favorable. From this list, 74 statements for the check list were selected, with preference given to those considered by supervisors as particularly pertinent to their departments. As the 1 to 9 scale was believed to be too exact for scoring individuals, the scoring key was established on a 1 to 3, plus or minus, basis. As each statement was weighted to one of these values, the total score of an employee could be quickly determined by subtracting minus values from plus values of all statements applying to the individual being rated.

Name _____ Clock No. _____ Total Points 740 Date _____ Department _____

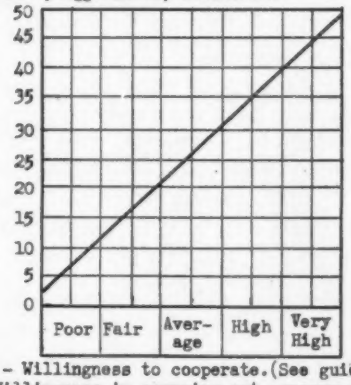
(175) I. QUALITY OF WORK - Appraises employee's performance in meeting established standards.
200 (1) Consistently excellent job, rejects rare.
175 (2) Usually excellent job, seldom makes mistakes.
150 (3) Good job most of time, occasionally careless.
125 (4) Only fair job on average.
100 (5) Work usually passable, but bears watching.
0-75 (6) Only gets by, careless, often makes mistakes.

(150) II. QUANTITY OF WORK - Appraises employee's productivity of satisfactory work.
200 (1) Very fast, consistent, high production.
175 (2) Fast and consistent production.
150 (3) Above average production.
125 (4) Average speed and production.
100 (5) Only fair speed and production.
0-75 (6) Slow and low production

(80) III. JOB KNOWLEDGE - Appraises employee's experience and how well he knows job.
100 (1) Expert on job, needs no supervision.
80 (2) Good, needs supervision occasionally.
60 (3) Average, regularly requires supervision.
40 (4) Poor knowledge, required much supervision.
0-20 (5) Requires constant supervision and instruction.

IV. POTENTIALITY - Appraises employee's inherent capacity for development and advancement.
(30) Age - Max. of 50 points to 25 years of age, less 2 points per year until 50 years.
(40) Health -
50 Perfect, vigorous, very seldom ill.
40 Good, seldom ill.
30 Fair, subject to common illness.
20 Poor, frail, frequently ill.

Adaptability- Ability to meet changes.(See guide chart)
(25) 50 Mental ability, analytical ability.
(30) 50 Versatility, dexterity.
(30) 50 Ingenuity, resourcefulness, talent.
(30) 50 Alert, aggressive, efficient.



Attitude - Willingness to cooperate.(See guide chart)
(40) 50 Willingness in carrying out company policies.
(10) 20 Obeys safety rules.
Dependability - Measures degree of trust in employee
(40) 50 Attendance, absence and tardy record.
(15) 20 Foreman's confidence in employee to carry out all instructions.
(10) 15 Character, personal,working habits,temperament.
(15) 15 Willingness to accept responsibilities and work under pressure.
(10) 15 Respect for tools.
(10) 15 Uses good judgment.

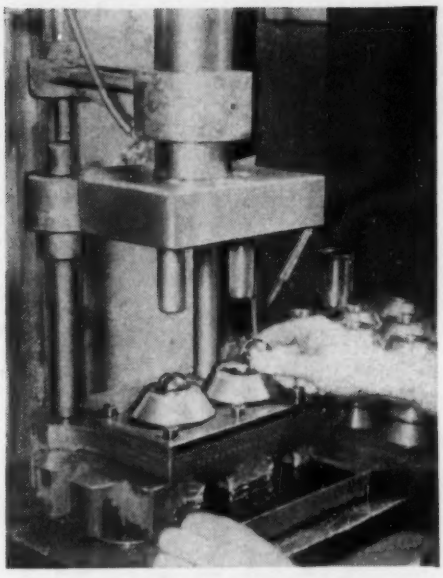
SEMI-ANNUAL RATING at Lincoln Electric is based on a weighted-point scale with a 1,000-point maximum. Unusual feature is a guide chart with actual graphic scale

Carbide-ball Burnishing

CUTS BORE-FINISHING COST 90%

BY JAMES BUSCH

CHIEF INSPECTOR, THE MASSEY-HARRIS COMPANY

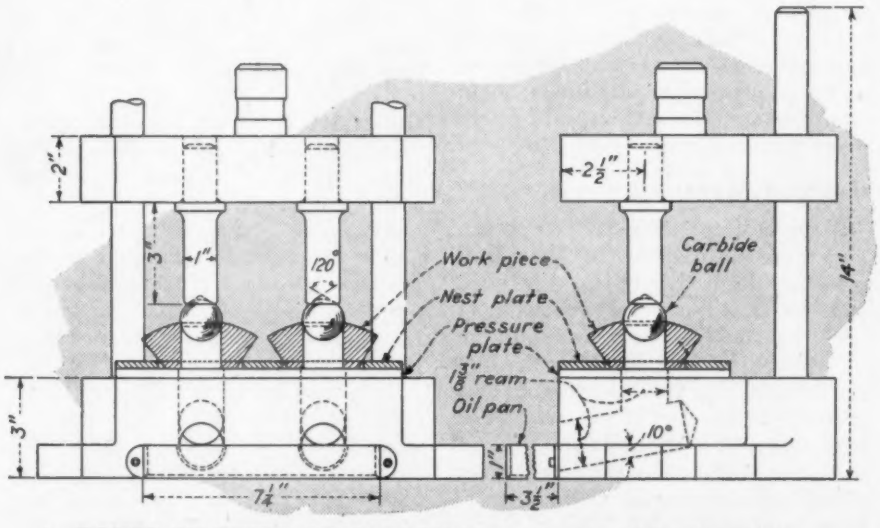


TWO BEVEL-GEAR BLANKS are ball burnished at each stroke of this hydraulic press. Fixture consists of a steel pressure plate, a nest plate and pressure pins assembled on a Danly die set. Fixture base is drilled so the carbide balls roll into a pan of oil after dropping from the work

BORES of SAE-4620 steel bevel gears for Massey-Harris tractors are being burnished with carbide balls at about one-tenth the cost of previous internal grinding. Two sizes of blanks are ball burnished. As produced on multiple-spindle automatics, the larger blanks are rough-reamed to 1.237-in. dia., leaving 0.005 in. of stock for burnishing. A 1.246-in. dia. carbide ball is used to obtain a 1.242-in. bore, because the bore contracts 0.004 in. after the ball has been pressed through the 1⅜-in. long blank. Smaller gear blanks are rough-reamed to 0.873-in. dia., balls are 0.877-in. dia., and the bore contracts about 0.002 in. after burnishing, thus producing a 0.875-in. finished bore.

For each size of blank, a special burnishing fixture has been developed. The one for the larger blank is shown; that for the smaller blank is identical but somewhat smaller in over-all dimensions. Essentially, each fixture consists of a standard Danly die set, with two 1½ x 14-in. back posts. The base of the die set has a 5 x 8½ x ¼-in. cold-rolled-steel pressure plate and a nest plate doweled and bolted to its top surface. Plates are carburized, hardened and ground before assembly.

Pressure plate and fixture base casting are drilled and reamed with two 1⅜-in. dia. clearance holes for the carbide balls, while the nest plate has two holes of sufficient size properly to locate the work and concentric with the ball clearance holes. In addition, the base casting is drilled and reamed with two passage holes inclined at 10° with the horizontal so balls roll to the fixture front after they have passed through the work. At this position there is a 3½ x 7¼-in. oil pan, 1 in. deep. It is formed from 20-gage steel and fastened to the front of the fixture base with two 8-32 socket-head screws. A light broaching oil lubricates the balls each time they are used.



BORES OF STEEL GEAR BLANKS are burnished in this fixture, designed for 1.246-in. dia. carbide balls. Balls follow previously reamed holes, will not correct axis angularity or warped bores

The two 1-in. dia. punches are concaved with a 120° countersink at the lower ends to center the balls in the bores of the work. These fixtures are used in a 15-ton American hydraulic press, and gage pressure is only 800 to 1,000 lb. The blanks are ball burnished before heat-treating; only a very small percentage of them need be returned for reburnishing after hardening. When this is necessary, 1.247-in. dia. balls are used for the larger blanks.

About a year ago, when ball burnishing first was attempted, steel balls were employed. They would average only about 200 pieces each before galling made them unfit for further use. One set of 1.246-in. dia. carbide balls has been used for eight months without signs of wear or galling. In that time, from 8,000 to 10,000 larger blanks have been burnished; an average of 4,000 to 5,000 blanks per ball. The 0.877-in. dia. balls have shown similar production.

Resulting Savings

Gear blanks were formerly rough and finish-reamed before heat-treating, then the hardened bores were finish-ground at a direct labor cost of 5c each for the larger and 4.5c each for the smaller blanks. Today, ball burnishing costs only 60c per hundred pieces for the larger and 30c per hundred pieces for the smaller.

How to Select and Treat MOLD STEELS

Plastics-mold surface defects from poor carburizing practice may offset steel selection and efficient polishing procedure

BY RALPH J. HOENSHEID
COMMERCIAL STEEL TREATING CORP.

PLASTICS MOLD DESIGN and construction is usually the most important factor in the success or failure of any molding program. Proper selection of steel or low-carbon irons, their subsequent heat-treatment and the recognition and correction of surface flaws are essential to a good mold. The finish of the plastics product will only be as good as the surface of the mold cavity.

Before a decision can be made on what mold metal is most suitable, these factors must be considered:

Will a hobbed mold meet requirements as well as a machined mold?

Must close tolerances be held on the finished product?

Is the particular plastic material abrasive or corrosive?

Is it necessary to have deep hardening or will shallow hardening be sufficient?

A good mold material must be free from porosity, non-deforming under hardening, have an analysis that can be brought to a relatively high hardness and with enough depth to resist sinking under extreme pressure. It must be resistant to both abrasive and corrosive action, so characteristic of plastics. It should also meet fabrication requirements.

Some plastics may not require molding in such a material, and the finished article can be made in a hobbed mold. In other cases, design and size of the cavity or the physical strength required will prohibit the use of low-alloy mold material soft enough for satisfactory hobbing. Where high tensile strength and resistance to abrasion or corrosion are prime considerations, mold cavities, unless shallow or small, must be machined.

Hobbing Materials

A practically pure iron that can be annealed to about 95 Brinell is often used for hobbing. A good iron of this type contains .03% C, .15% Si, .15% Mn and a maximum of .03% of S and P. To maintain uniformity and quality only a part of each ingot should be used. The iron must be melted and subsequent operations maintained under close control to insure freedom from gases and inclusions.

The iron is carburized, re-heated, quenched in water, brine or caustic solution and drawn to the required case hardness. This produces a cavity with the necessary case hardness but has a core not greatly improved in its physical properties. The stresses set up in the hobbing operation may result, however, in some movement during the hardening process if the hobbed cavities are deep and intricate. Final deformation can be minimized if, after hobbing, the die is stress-relieved.

This can be done by heating to about 1300 F, followed by an air cooling or by pack annealing from about 1650 F, and furnace cooled. After hobbing the mold is carburized at 1650 F, hardened and drawn to required case hardness.

A better mold iron, which can be obtained at about 120 Brinell hardness and satisfactorily hobbed, contains .10% C, .50% Mn, .50% Cr. and 1:25% Ni. Two hobbing operations are used, with an intervening stress relief or anneal to relieve cold-working stresses.

After the cavities are shaped, molds should be carburized to the proper case depth and hardened to required case hardness. This analysis holds up better under heavy molding pressures.

Two tool steels of the oil hardening, non-deforming type, are in general use for plastic molds. The first type contains .90% C, .32% Si, 1.55% Mn, .20% Cr and a maximum of .025% S and P. The second contains .95% C, .33% Si, 1.25% Mn, .60% W, .45% Cr and a maximum

of .025% S and P. These steels usually come in a Brinell hardness of 207 and may be hobbed if the impressions are shallow, or if annealed between successive hobbing operations. Otherwise the mold must be machined.

Recommended heat-treatment for these steels is oil quenching from 1450 F, and drawing to hardness specifications. The second type, containing tungsten, is hardened by oil quenching from 1500-1525 F, and drawing. Both these steels are acceptable to the plastics industry because they can be readily machined and hardened in low temperatures in oil, with a minimum of deformation.

A favorite steel for machined molds is one containing 1.00% C, .30% Si, .70% Mn, .25% V, 5.25% Cr, 1.00% Mo and a maximum of .025% S and P and is obtainable at about 217 Brinell hardness. Because of the high percentage of alloys it cannot be hobbed. It is machined and hardened by air cooling from 1800 F. For general purposes the mold is tempered to a Rockwell C hardness of 56-58.

This steel has a maximum of nondeforming properties and will polish to a high luster because of its chrome, molybdenum and manganese content. It is resistant to abrasion and corrosion and is deep hardening and air-cooled. Absolute prevention of corrosion when molding certain highly acid plastic materials has not been completely solved to date.

Stainless Steel Molds

Stainless steel of the 18-8 type would solve the corrosion problem, but it is too low in carbon to harden by conventional methods without impairing its corrosion-resistance.

The 420 type of stainless may be used where resistance to corrosion is required. It will attain a hardness of about Rockwell C 53 when hardened from 1825-1850 F in oil and will outwear some steels having higher hardness because of its high chrome content (about 14%).

Type 440-A stainless steel is hardened from 1850 F giving a Rockwell C hardness of 57. Both these types are drawn at about 400 F, and can be hardened in either air or oil. Oil hardening is better for large sections. Type 440-B with .85% C and 17.50% Cr can be obtained at 228 Brinell and hardens from 1850 F in either air or oil and will give extra toughness and a hardness of Rockwell C 60-62.

Non-ferrous metals in various compositions are being used more widely in the plastics industry. Beryllium copper as a cavity material will reproduce the finish of the master it is cast upon and will harden to about Rockwell C 40. It is quite tough and does not tend to chip or crack. Newer alloys are being developed that will harden to 50 Rockwell C. Beryllium copper finds its main use in cavities for injection molds where close tolerances in the finish product are not required.

Mold Surface Defects

Discoloration of mold surfaces, if it does not progress to a more serious condition, is of no serious consequence. Quite often it is the first step in the development of scaling, orange-peel pitting, and pimpling. Under certain conditions, discoloration goes deeper and deeper until it develops into a light film of scale. With these conditions continuing, the light scale will go deeper until a heavy scale is formed.

If three primary contributing factors, O, CO_2 and H_2O are removed, there will be no discoloration. Atmosphere-control measures will in most cases eliminate these factors. Scaling, which is an exaggerated condition resulting from discoloration, can be prevented by maintaining this rigid control of atmosphere.

Orange-peel, pitting and pimpling are one and the same thing and differ only in degree. Orange-peel can be traced to a mild or light acid etch, whereas pitting and pimpling are caused by a stronger or more prolonged acid etch or a light scale. The low-carbon irons are easily attacked by even a mild acid, but the higher the alloying elements the greater the length of time required for attack.

In an orange-peel condition of the mold surface there is a slight wavy appearance, but in pitting or pimpling it is increased and gives a pattern of raised pimples or small "crater" formations. The majority of orange-peel surface conditions come in the treating of alloy steels rather than the straight low-carbon steels or irons. Pitting and pimpling seems to be confined to the latter.

In carburizing by the pack method, acid attack on the part or die surface may be caused by damp carburizing compound. However, when the carburizing compound was soaked in water and highly polished test pieces packed in the mixture, no orange-peel or pitting occurred. Apparently the acid for-

Polishing Procedure

While these recommendations will give better finishes and improved molding results, much of the success in polishing comes from experience and knowing when to mask certain parts of the cavity to protect detail of sharp corners. In soft polishing, pressure is important if torn or pitted material is to be avoided.

1. Saw steel to length.
2. Machine relief in bottom of slug.
3. Surface-grind face of slug.
4. Polish with emery cloth, using successively graded Nos. 150, 180 240 and 400.
5. Buff face with polishing wax No. 760 on a felt wheel.
6. Cup brush face with 1-A abrasive compound.
7. Wash off compound with solvent such as carbon tetrachloride, and dry.
8. Brush with levigated alumina and water, using cup brush.
9. Hob, using copper sulphate.
10. Wash cavity with ammonia to remove copper sulphate.
11. Remove ammonia with hot water.
12. Machine cavity.
13. Soft polish.
    a. Remove draw lines with emery cloth on an orange stick using Nos. 180, 240 and 400 cloth.
    b. Polish sides with 1-A abrasive compound, using orange stick.
    c. Brush bottom and side wall with 1-A abrasive compound.
    d. Wash.
    e. Buff bottom and side wall with polishing wax on felt.
    f. Brush with tetrachloride and wax.
    g. Wash.
    h. Dry.
    I. Brush with levigated alumina.
14. Heat-treat.
15. Hard polish.
    a. Brush with 1-A abrasive compound.
    b. Wash in carbon tetrachloride.
    c. Buff with wax on felt.
    d. Brush with levigated alumina.
    e. Cover cavity with vaseline.

Note: Source of any of the materials mentioned will be given on written application.

Common Surface Defects

Discoloration

A change from the original machined appearance to any one or all of the colors, varying from light straw to dark blue or black, and caused by oxidation from the action of oxygen, carbon dioxide or water vapor and accentuated in the presence of heat.

Scaling

An attacked surface caused by a corroding agent such as oxygen, carbon dioxide or water vapor, resulting in an oxide of iron and usually extending over fairly large areas and showing up as a "patched" formation.

Orange Peel

A wavy effect caused by mild action of a corrosive agent, usually but not always an inorganic acid.

Pitting or Pimpling

A pronounced etch from a corrosive agent, usually an inorganic acid, resulting in formation of "islands" or "pimples" and sometimes fairly deep depressed areas. A "crater-type" formation may also appear.

mation was so diluted as to have no reaction.

Some of the factors to be considered in investigating acid formation are:

1. Whether the mold to be carburized, the pack or the compound is in a damp condition.
2. Foreign substance on the mold before packing.
3. Presence of slight oil films, which include sulphur.
4. Sulphur left as a residual element in the coke used in manufacture of carburizing compound.

Where optimum surface condition is required, the mold must be free of all foreign substances. If clean molds or cavity sections are cold or below room temperature they will, under certain conditions, produce a sweat on the surface after being packed. Air usually exists in the interstices of carburizing compound granules. As heating progresses in carburizing, a slight film of water is deposited on the surface of the steel. This slight amount of water, by reacting with the sulphur or foreign matter on the surface of the parts, will form sulphuric acid.

The sulphuric acid formed under this condition is in a more highly concentrated state than if the carburizing compound had been thoroughly wetted, and attacks the surface more actively.

This acid condition, responsible for orange-peel, pitting and pimpling, can best be remedied by packing the surface in charcoal and placing the carburizing compound around the charcoal. However, the same conditions will re-appear unless formation of water vapor in the form of sweat or dew on the part is prevented, either before or after it has been packed.

This can be averted by seeing that the parts are not packed when cold or damp and taking extra precautions to keep the charcoal and carburizing compound dry in humid weather. The charcoal should be well blanched. All molds should be carefully washed in carbon tetrachoride to remove all traces of any foreign matter such as grinding compounds, oils, cutting compounds, drilling and tapping materials and any compound containing lead. Surfaces should not be touched with hands or fingers.

In a controlled-atmosphere furnace with wet gas atmosphere the water vapor, intentionally present, causes a milder attack on the surface of the orange-peel type.

When a recirculator is cut in to get rid of all water vapor the orange-peel and pitting is almost immediately corrected. A dry sulphur-free gas is produced which cannot form objectionable compounds.

Many treatments are being applied today that are worthy of investigation in the search for better mold surfaces. Some of these are copper plating of self-hardening steels and stripping after hardening; application of dissociated ammonia; use of tungsten and platinum for plating prior to heat-treating and stripping afterwards. Electrolytic polishing, gas and liquid carburizing also look good.

These precautions, when combined with effective polishing and buffing techniques, will provide mold surfaces free from imperfections. Polish procedures are recommended but should be governed to some extent by the experience of the user.

Note—This article, in part, is based upon an address by the author at a meeting of the Metal Treating Institute in Colorado.

OUR SHOP . . . 16 — *Precision Forging Dept.*

Hobbed Gear Tooth Layout Simplified—3*

Additional values cover small numbers of teeth, amplify tables

BY CLYDE A YOUNG
PROJECT ENGINEER
HUDSON MOTOR CAR COMPANY

IN USE, it was found that the table of "C" values (given in the author's earlier articles) was not extensive enough for small numbers of teeth. Below are given additional values for these extreme cases:

The corner of the hob completes its cutting before the involute is entirely generated, so the table of C_1 values has thus far been sufficient for all cases tried.

Use of the RC and RC_1 tables is more universal than might be supposed. It is rather common practice to consider that no one can draw more accurately than 0.010 in.; therefore, any differences less than this in the tables are insignificant.

For example, for C = 0.0032564 and a radius of 10, CR would be drawn as 1/32 in.; so would R = 11 and R = 12. Thus, any fractional value of R between 10 and 12 is unimportant for drawing, and it is sufficiently accurate to take directly from the table the RC value nearest the given radius.

Suppose the radius is 10.1234 in. For a 1 to 1 scale, RC values for R = 10 are closer than one can draw. For a 5 to 1 scale, using R = 10.1234 x 5 = 50.6170, the nearest tabulated value is 51, and the approximate compared to the actual is only 0.0038 in. different for C = 0.0100206. For a 10 to 1 scale, R = 101.234, and R = 100 (10 x 10) is nearest. For C = 0.0100206, the error is 0.012365, and the actual RC value should be used. But for C = 0.0073483, the table's RC may be considered close enough because the error is less than 0.010. For smaller values of C, the errors would be even less.

A quick inspection of the tables for a particular radius and scale will show how far the tables can be used, and where actual calculations begin.

Values for RC and RC_1 have not been given for greater values of C and C_1 because they approach closely to the 0.010 in. limitation.

**Two earlier articles appeared several months ago.*

K	K_a	Sin K_a	C
21	42	.66913061	.0955085
22	44	.69465837	.1055000
23	46	.71933980	.1160948
24	48	.74314483	.1273146
25	50	.76604444	.1391827
26	52	.78801075	.1517244
27	54	.80901699	.1649666
28	56	.82903757	.1789385
29	58	.84804810	.1936716
30	60	.86602540	.2091996
31	62	.88294759	.2255586
32	64	.89879405	.2427881
33	66	.91354546	.2609304
34	68	.92718385	.2800307
35	70	.93969262	.3001384
36	72	.95105652	.3213064
37	74	.96126170	.3435920
38	76	.97029573	.3670576
39	78	.97814760	.3917703
40	80	.98480775	.4178029
41	82	.99026807	.4452348
42	84	.99452190	.4741521
43	86	.99756405	.5046483
44	88	.99939083	.5368259
45	90	1.00000000	.5707963

CORRECTIONS

In final proofreading of the tables in the two preceding parts of this article, several errors were missed. These are:

In Table II (first article):

For C = .0008128, R = 22, CR should be .0178816 instead of .178816.
For C = .0018301, R = 58, CR should be .1061458 instead of .1061457.
For C = .0050948, R = 69, CR should be .3515412 instead of .3515421.
For C = .0050948, R = 98, CR should be .4992904 instead of .4992004.
For C = .0073483, R = 60, CR should be .4408980 instead of .4408900.
For C = .0100206, R = 60, CR should be .6012360 instead of .6013260.

In the second article:

CG = BH = R = R_r, etc., should be CG = BH = R — R_r, etc.

Table I, for Ka = 4, C_1 = .0016238 instead of .0016236.

In Fig. 5, the right-hand lower right angle should have been labeled "E."

Also, the right-hand arrow head for ∠ Ka should go to the next line (to line OA).

In Table II:

For C_1 = .0004066, R = 28, RC_1 = .0113848 instead of .0113948.
For C_1 = .0146647, R = 41, RC_1 = .6012527 instead of .6012427.
For C_1 = .0016238, R = 79, RC_1 = .1282802 instead of .1283802.
For C_1 = .0016238, R = 85, RC_1 = .1380230 instead of .1380239.
For C_1 = .0036582, R = 59, RC_1 = .2158338 instead of .2148338.
For C_1 = .0065070, R = 59, RC_1 = .3839130 instead of .3839120.
For C_1 = .0101747, R = 55, RC_1 = .5596085 instead of .5596058.
For C_1 = .0146647, R = 99, RC_1 = 1.4518053 instead of 1.4519053.

Learning From Others

FOR YEARS Chas. F. Kettering, V. P., Research Div., has said he welcomes visitors to the laboratory because he always learns something that improves his perspective. . . . Hydraulic Machinery, Inc., Detroit, has this notice to visitors posted in the lobby:

WELCOME TO HY-MAC

We are glad to have you call. Make yourself at home. It is important that we keep in touch with latest developments and, if you can tell us something new, or show us how your equipment or products can help us do a better job, we shall appreciate it.

The practice of the Golden Rule should begin at home, so we shall keep you waiting no longer than absolutely necessary. We, too, have salesmen calling on the trade and we hope they receive a cordial welcome from our customers.

Thank you for your visit—you're always welcome.

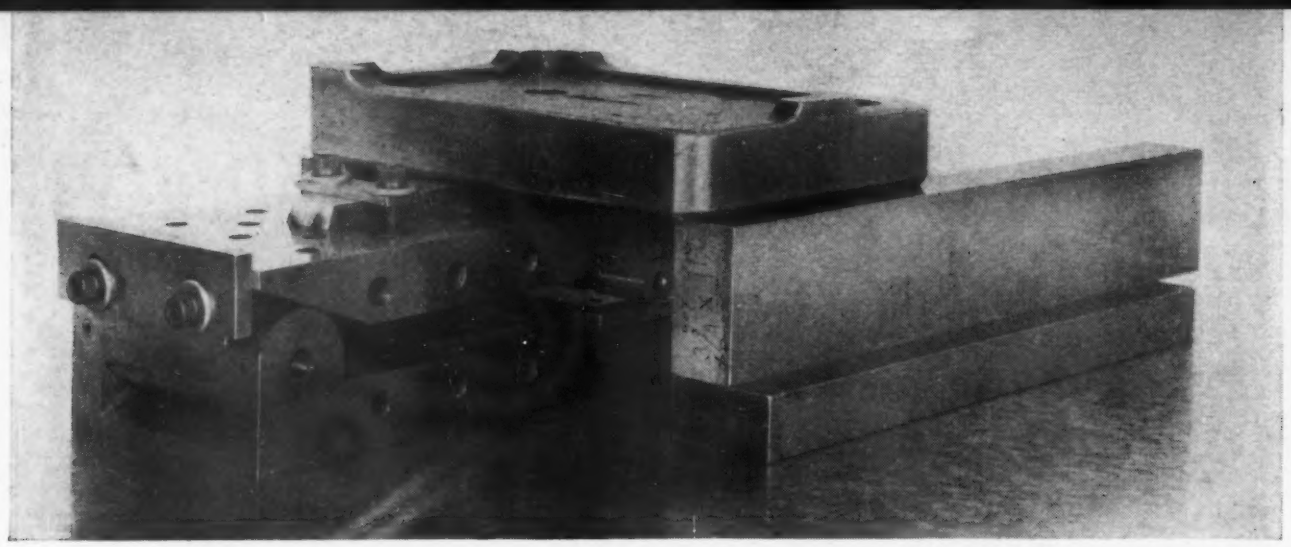


Fig. 1—Ordinary parallels position the lap. A true angle can be lapped easily by moving the surface-finish block under the flat lap

Tapering for Surface Inspection

BY LT. COL. W. J. DARMODY, ARMY SERVICE FORCES

Lapping overcame the need for plating in Army Ordnance tests of the taper section method of evaluating surface finish

EXPERIMENTS with taper sectioning, conducted in connection with standardization of Ordnance finish blocks, indicate new uses of this method for surface-finish evaluation. Tests, made at the Frankford Arsenal Gage Laboratory, are of particular interest because the taper sections were formed without plating the surface to be evaluated.

Taper sectioning is performed by grinding and lapping a tapered area on the surface to be analyzed. This section should be deep enough to remove all traces of the machine surface finish at the lowest point and should make only a slight angle with the surface—usually angles between 1 and 2½° are chosen.

Length of the V-shaped forms where the lapped surface intersects the machined surface is measured with a toolmaker's microscope. Knowing the angle of the taper, depth of the grooves can be determined by multiplying this length by the tangent of the angle.

Machining methods used to prepare a block for surface inspection at Frankford Arsenal follow:

1. Place the block face down on a surface grinder and grind the bottom until it is smooth. It is best to select blocks with reasonably flat surfaces to prevent the piece from bending or moving in the surface grinder. If the block face has a convex surface, it may be necessary to "pack up" the block to keep it from teetering or being pulled out of true shape by the magnet force.

2. Clamp the block on a sine-block fixture with the surface to be inspected uppermost. The sine block should be set up at the desired angle of taper. The grain of the surface finish serration (lines formed by the peaks and valleys) should be placed parallel to the edge of the sine block. This adjustment can be made with a toolmaker's microscope.

3. Place the sine-block fixture on the chuck of a surface grinder and grind a flat section deep enough so all traces of the surface-finish grooves will be removed at the lowest portion of the section.

4. Lap the tapered section. This operation should be done with considerable care to retain a true and uniform angular surface, otherwise accuracy of the readings may easily be affected. A true angle can be lapped easily and quickly by setting a flat lap on top of two parallels and by moving the surface finish block under it, still held by the sine-block fixture. Ordinary parallels can be

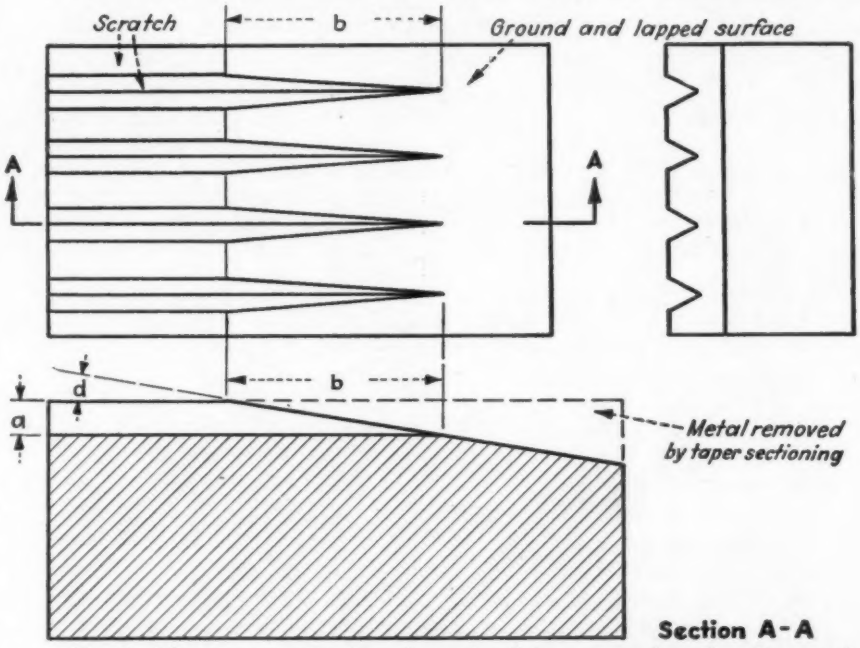


Fig. 2—After taper sectioning, dimension *b* is measured easily with a toolmaker's microscope, whereupon the total depth of scratch is found by formula; depth of scratch = *b* tan *d*

used for positioning the lap but sometimes more precise positioning is required, such as with gage blocks or adjustable-taper parallels. The tapered section on the block should be 0.0002 or 0.0003 in. higher than the bottom of the lap to provide for stock removal.

5. Preparation of the specimen is now complete and it can be evaluated by an ordinary toolmaker's microscope with magnification of about 30 dia. The coordinate micrometer stage of the toolmaker's microscope lends itself to quick and easy evaluation of the traces of the finish marks on the tapered section.

A 500-grit boron-carbide lapping compound was used at Frankford. This gave a high polish to the tapered section and made it unnecessary to use nickel plating or other methods sometimes used to bring out the difference between the tapered section and the grooves.

The block shown in Fig. 3 had a nominal surface roughness of 250 microinches root-mean-square. Angle of the tapered section amounted to 1°. Since the average length of the V-shaped figures formed at the junction of the machine surface and the lapped surface was about 0.059 in., the average full depth of the grooves was known to be 0.059 times tan. 1°, or about 1,000 machines (0.001 in.).

The block shown in Fig. 4 had a nominal surface roughness of 500 microinches RMS. The angle of the section was 1½°. Length of the V-shaped figures as measured on the microscope proved to be about 0.075 in. Therefore, the full depth of the grooves averaged 0.075 times the tangent of 1½°, or about 2,000 microinches (0.002 in.) full depth.

Two Light Positions

There are two different ways of positioning the light for examining surface finish under a microscope: one is with the light rays perpendicular to the grain, and the other is with the light rays parallel to the grain. Figs. 3 and 4 were taken with the light source at one side of the block, making the light rays perpendicular to the grain. This most clearly brought out details related to the surface within the grooves.

The block illustrated in Fig. 4 is shown in Fig. 5, but the light source was placed near the end of the block to make the light rays parallel to the grain. This method made the tapered surface very clear, thus making it easy to measure the depth of the grooves and to determine their general contour accurately. It told nothing, however, about the type of finish within the grooves themselves.

For finishes of 125 microinches RMS and rougher, the methods described offer a simple approach to surface finish evaluation with ordinary facilities available in a toolroom. The method can be used for evaluating surface finishes finer than 125 microinches RMS, although experiments at Frankford Arsenal dealt with rougher blocks.

Fig. 3—This block had a nominal surface roughness of 250 microinches RMS and the angle of the tapered section amounted to 1°. Average full depth of grooves was determined at 1,000 microinches. Light rays were positioned perpendicular to the grain. The magnification is about 32.5 diameters

Fig. 4—Shown at about 32.5 dia. magnification, this block had a nominal surface roughness of 500 microinches RMS and the angle of the tapered section was 1½°. Full depth of the grooves averaged 2,000 microinches. Light rays were likewise perpendicular to the grain

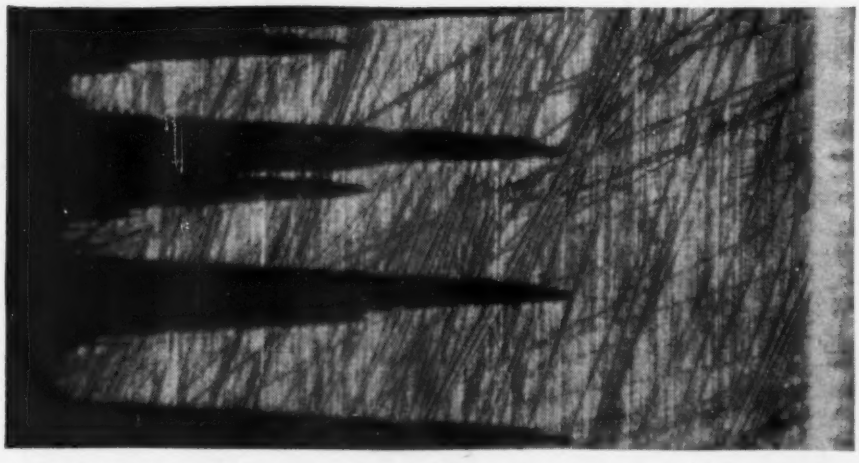
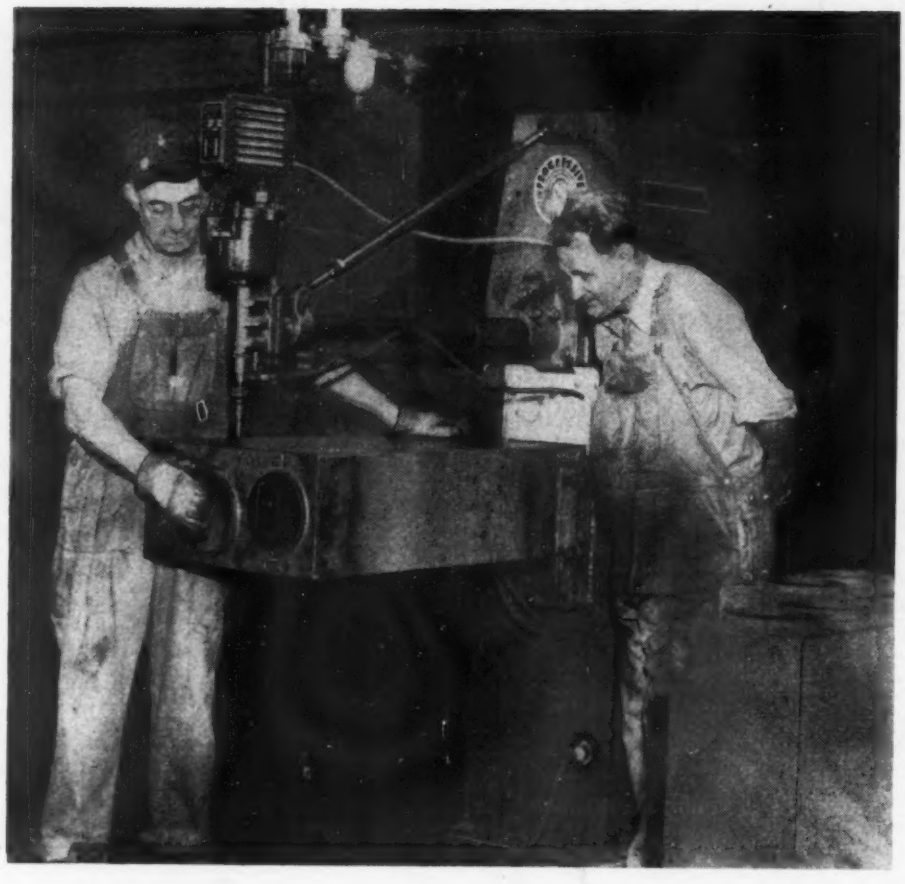


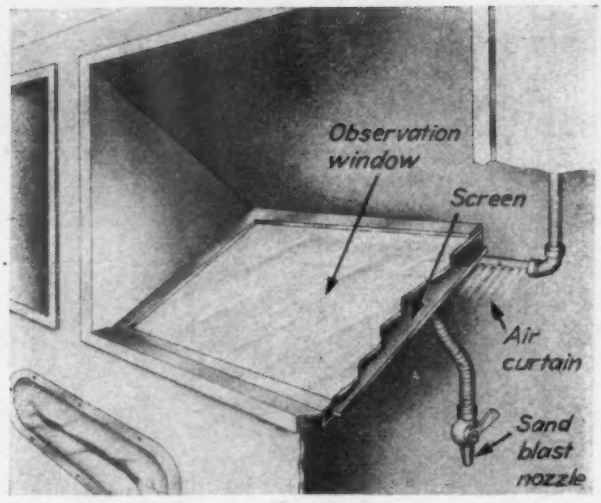
Fig. 5—This view of the block in Fig. 3 was taken with light rays positioned parallel to the grain. The tapered surface stands out clearly and the depth of grooves can be measured easily. However, this method reveals nothing about the finish within the grooves

SHOP SHOTS

RADIATOR ASSEMBLIES are being soft-soldered 280% faster, and loss of solder eliminated by a six-station induction-heating work unit at International Harvester Company. Prefabricated solder rings provide uniformity of joint strength and deposit. By staggering the units, bottom and top tank assemblies can be handled in line technique. Heating cycle is 30 sec. *The Ohio Crankshaft Co.*

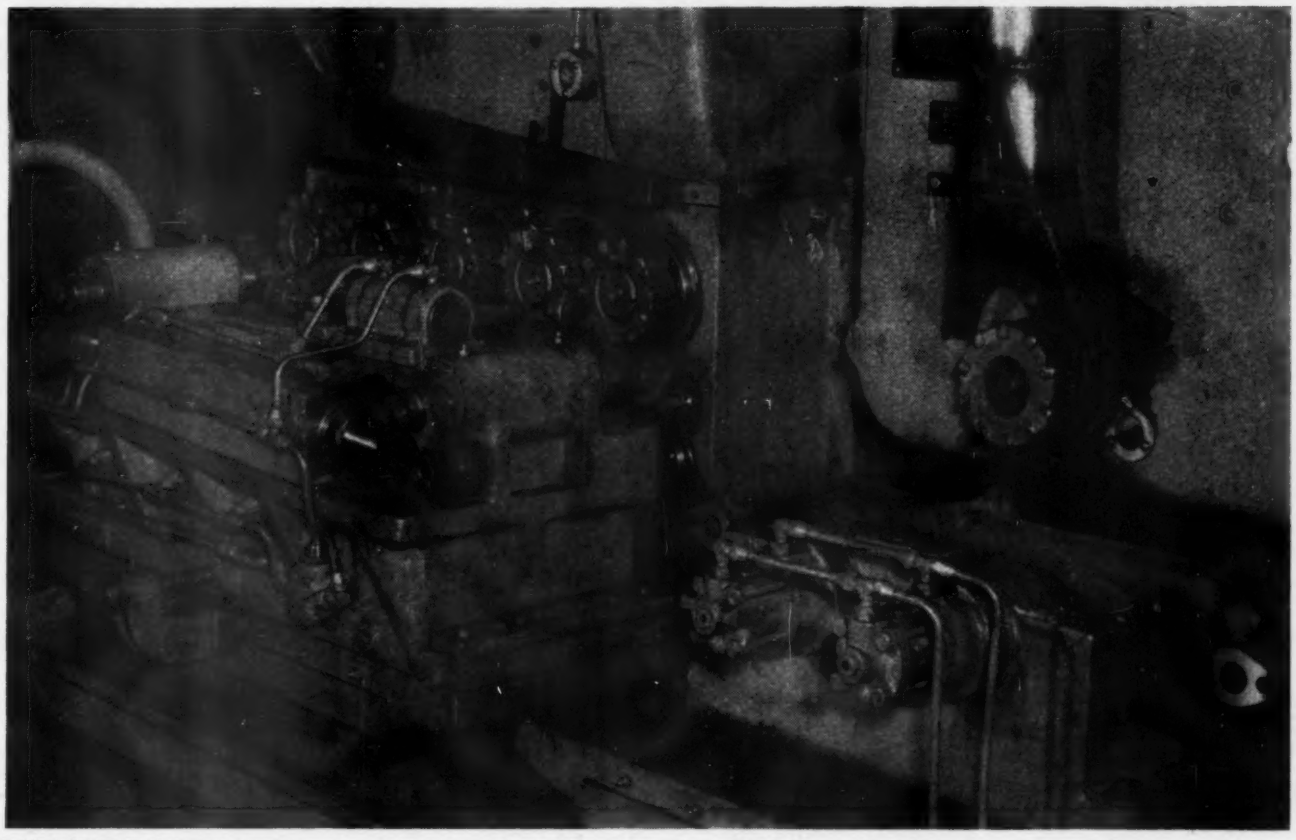
WELD MARKS on dispensing tanks have been eliminated at Hollister Whitney Co., by bracing the upper horn of this pedestal welder from the machine column. This has eliminated deflection at the electrodes in such a deep throat setup and at the same time enabled production to be increased one-third. This type of support can be readily applied to standard equipment. *Progressive Welder Company.*





SANDBLAST observation windows are now being protected from pitting by an air curtain which forms across the window and deflects sand particles. A ¼-in. pipe, in which a number of holes have been drilled, is mounted along the window on the lower side of the glass and can be installed in any type of sandblast equipment. *Westinghouse Electric Corp.*

NEWLY DESIGNED TACHOMETERS, which can be read easily from a distance, have been installed on the final check line at Studebaker and have increased accuracy and efficiency. These instruments are used in running new cars through the gear ranges, with the wheels on rollers. The same idea is being extended to other operations where tachometers are used.



RISE-AND-FALL MILLING of manifolds and similarly shaped parts has been speeded with hydraulic fixtures. Ten cutters in the head at left rough and finish five flanges while the operator loads the fixture at the right for machining one flange on an opposite face. Manual effort is reduced substantially as the operator does have to adjust or clamp the fixtures. Constant locating assures greater uniformity. *Buick Motor Division.*

ROUND TABLE

Who Pays for Breakage?

"I hear John Marks almost took a poke at Bill Paine the other day, Ed. What was it all about? Somebody said Bill busted a pet dial indicator of John's that he'd borrowed. But that doesn't seem big enough for John to get so upset. What's the straight of it?"

"That's about right, Al, except for two things. Bill borrowed the indicator before, with permission, so figured he could borrow it again when John wasn't around to ask. Then when he brought it back busted, he told John to bill the company for it—after all, it had gotten busted on company work. John said it was Bill's clumsiness that busted it, and that he was a so-and-so for trying to get out of paying for it."

"Well, if the company supplied all tools, there wouldn't be any problem."

"Yes there would, Al—it could have been John's watch or his pencil, or something else. But it's definitely Bill's fault and he's the guy who pays for the fixing."

"You seem to assume, Ed, that anything that happens is somebody's fault. After all, something could have happened to the machine he was using the indicator on. Or let's go a step further and assume somebody stole the indicator. Would that still be Bill's fault?"

"As far as I'm concerned, it would, Al. As long as Bill had it, he was responsible for it. If he left it where some light-fingered guy could pick it up, or if he broke it, regardless of how, it's still up to him to make good."

"Look, Ed, neither John nor Bill gets any dough to buy tools with, or any special pay for having 'em. If John is good-hearted or pernickety enough to use his own tools when he has to, the company ought to be willing to replace 'em when something like this happens."

"Al, it's up to John if he uses his own tools, and up to Bill if he takes a tool of John's and cracks it up. That's the way it has always been."

"But I doubt if that's the way it ought to be. It's time the company stood back of tools used on company work. I'll bet if one of the Big Shots ruined a suit out here, the company would come across. . . ."

"Why should they, if the guy got in the way of hot metal or paint or something?"

"For the same reason they take care of a guy who gets hurt. What's the difference if it's a hand, a coat or a tool? The accident in each case occurs on company property, during the working day, and on company business."

"Yeah, but giving a guy first aid is just being human—and saves later complications and lost work if the guy neglects it. That doesn't fit on clothes or tools."

"Yes it does, Ed. A spoiled suit or a spoiled tool can get a guy just as upset in his mind as a hurt finger. I think if the company helps in injuries (even if it does disclaim responsibility for outsiders hurt), it should do the same for tools and clothes if the damage wasn't caused by carelessness."

WHO SHOULD PAY *for employee-owned tools in case of disappearance or damages? Is the company morally responsible when it permits personally owned tools to be used on the job? What has your experience been? Other readers would like to know what your opinions are. Discussions of earlier topics appear on later pages of each issue.*

Practical Ideas

Floating Driver Speeds Mandrel-Mounted Work

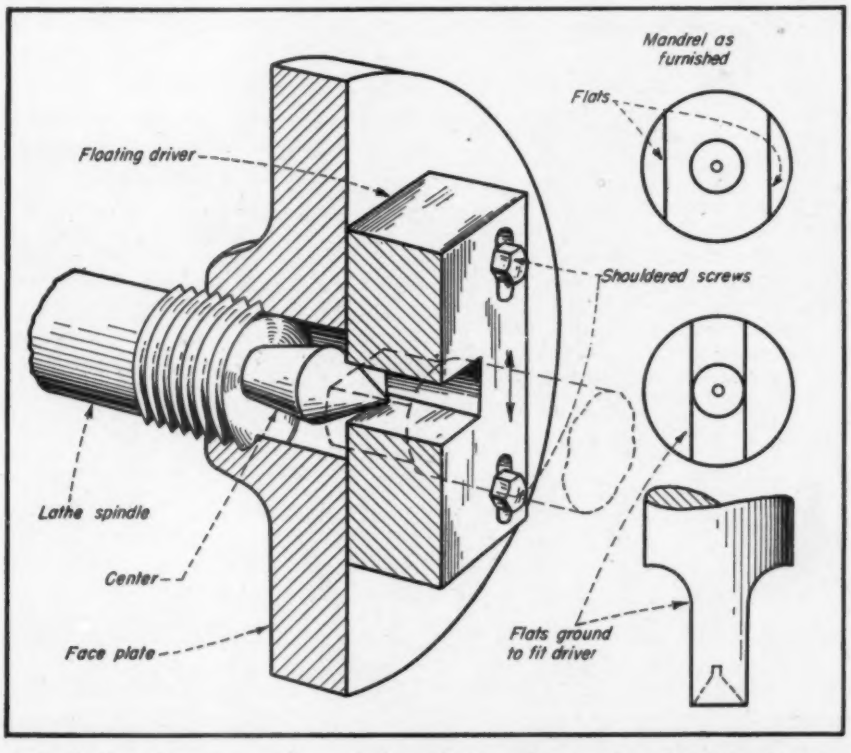
DONALD P. ZIEMKE
Oak Ridge, Tenn.

The inventive lathe operator, with a big order job requiring the use of a mandrel, will attempt to get out of using the time-honored lathe dog. On a short-cycle production job, the time element involved in removing and replacing the dog between pieces is an important item. The usual substitute for a dog is a piece of angle iron strapped to the face plate so as to engage the flat on the mandrel. This is not a good practice as the driving torque applied against the small flat is so great that it will force the mandrel to run out of true. The lathe dog does not apply the torque at one point, therefore this condition does not occur.

Automatic lathes handle work successfully with a driver. They use twin-flat mandrels and a floating driver which applies the same forces to each side. The illustrated suggestion is an adaptation which can be used on engine lathes with equal success. The double flat can be ground off-hand but standardize at ½, ¾ and 1-in. widths as the mandrel size will allow. Driving plates can be made in the three sizes. The required plate is fastened to the face plate with capscrews as indicated. The face plate is drilled and tapped to a depth whereby the screws may be drawn up tightly without binding the driving plate; the plate must be free to seek its own center around the mandrel. It cannot be tightened up unless you care to mark the mandrel and the plate so that it can be put in the lathe the same way each operation. The mandrel flats are never a perfect match. A short live center is required so it will not interfere with the driver. A hard center is recommended to eliminate the need for frequent redressing and reduction in length.

There are many other advantages to this type of drive besides the time-saving feature. It will not slip and spoil the live center, the mandrel, the job and the cutting tool. Being flat and smooth, it will not tangle up hot chips and splash coolants. The compound rest can be run in closer than a lathe dog will permit, a very nice feature, especially with short mandrels. Being centered, it will not cause vibration in light, high-speed lathes.

The plates should be made from at least ⅜-in. material. If they are to be subject to a great deal of use, it is a good idea to harden them to reduce the wear. Some lathes have spindle sleeves that project beyond the face plate. It will be necessary to add a master plate to the face plate in order to be able to mount the driver beyond this obstruction. Another solution might be to make the driver out of thicker metal, providing space for a deep counterbore.

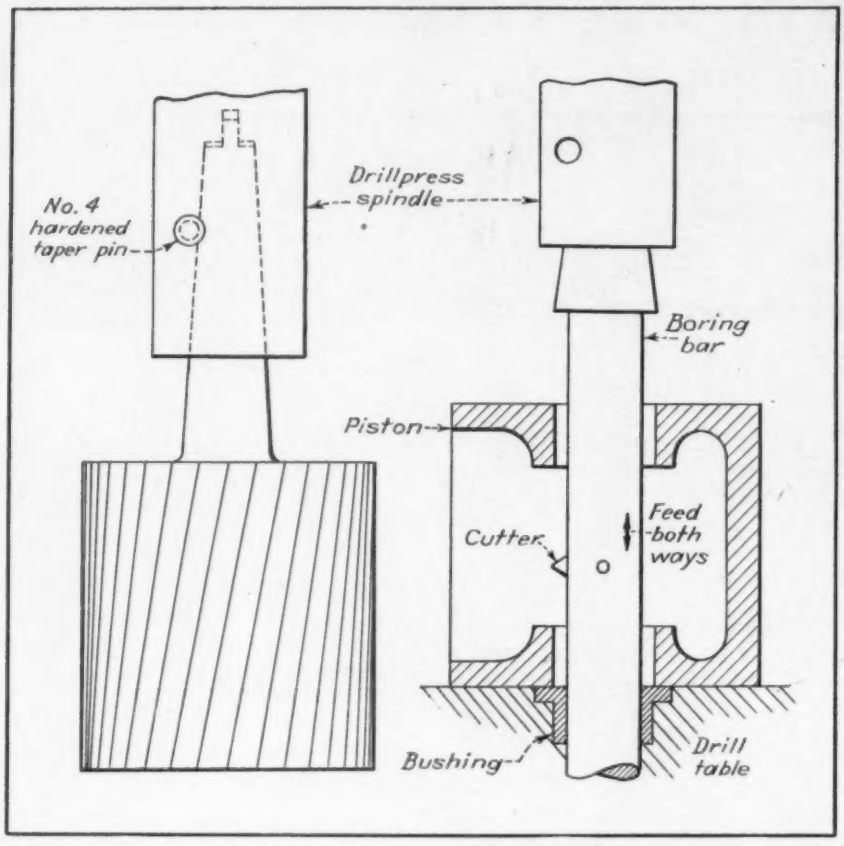


Grind deep flats on your mandrels and drive them with a floating plate to eliminate time-wasting dog changing

Taper Pin Locks Taper Shank Boring Bars

LEWIS W. and C. H. SPAULDING
Warrenton, Oregon

While operating our own shop we used to ream many Model T Ford blocks to 1/32-in. oversize on a radial drill. The reamer was quite heavy so to prevent it from falling, I drilled through the radial spindle about half way up the No. 4 morse taper so that the hole was about 2/3 in the spindle and 1/3 in the taper of the reamer shank. Then I reamed this hole with a No. 4 pin reamer. By using a hardened tool-steel taper



Reamers, fly cutters and boring bars are securely held and cuts can be made on the upstroke

pin to fit this hole, the reamer stayed in place.

The above method of keeping heavy tools in the radial drill worked so well that I applied it to our 20-in. drillpress to hold boring bars. With a bronze-bushed hole in the drillpress table to support the lower part of a boring bar, we could bore any work within the swing of the press—in this case about 22 in. We also used a boring bar thus held to bore piston-pin holes and to face the inside bosses of pistons. As the bar is firmly held, one can bore or face feeding either up or down.

This work can be done in a small shop with limited equipment after the piston is machined in the lathe. While chucked to face and taper the piston skirt, we used to bore into the inside pin bosses to center and indicate the depth of cuts to be taken later in the drillpress.

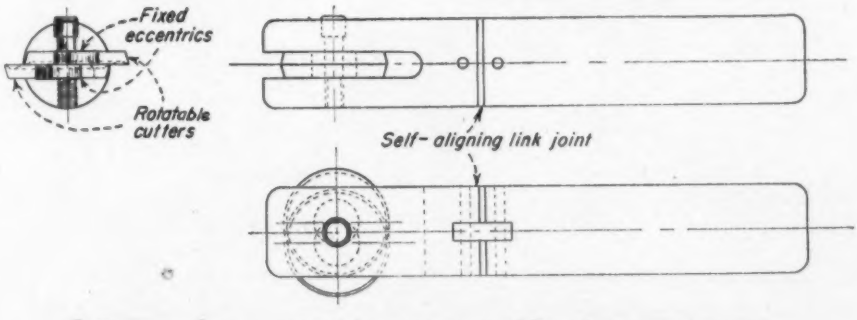
These bosses are quickly and easily bored and faced by a double-end, double-faced tool or a fly cutter held in the boring bar. Also, many other boring, facing, counterboring and countersinking jobs can be done with this setup.

Double-Eccentric Circular Cutters Improve Reaming

J. COPELAND AND R. HOLSING
Canton, Ohio

Longer tool life, especially in screw machine work, is the advantage of this reamer. The two circles are easy to grind and when mounted on their eccentric centers, they are free to turn, automatically giving a new cutting surface as the reamer advances.

A center spring in the shank, perpendicular to the cutting axis, holds the head rigidly in one direction but permits self-alignment on the cutting diameter.



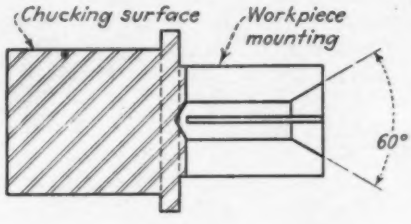
Cutters revolve on eccentric centers providing large cutting area

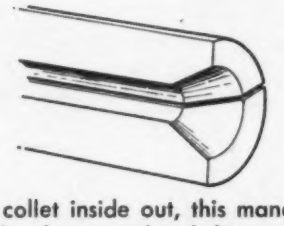
Expanding Mandrel Permits Quick Work Changes

ORVILLE H. GITTER
Appleton, Wisconsin

With this mandrel, pieces can be slipped off and on and the next work cycle started with only a few seconds delay, and without stopping the lathe. The body diameter is straight and flanged, allowing the work to slip on to the same position every time so carriage stops need never be changed when making complicated cuts.

The principle is that of a collet in reverse. The mandrel is split longitudinally two ways and is outside-finished a trifle undersize so work will slip on easily and come off without resort to a press. An easy way to get the expansion force is to use a rolling-bearing center to support





Like a collet inside out, this mandrel expands when a tailstock live-center presses against it

stock, which also serves to support the work. Or, as an alternative, it would be easy to make a draw rod pulling through the center and confining the action to the headstock spindle alone. This would be the better way when using the mandrel in a turret lathe.

Different Drillrods Set Correct Tapers

ARTHUR F. HIRD
Lakeview, Ontario

Milling slots with tapered sides for any of a great number of jobs can be done quickly and accurately when set up in this way.

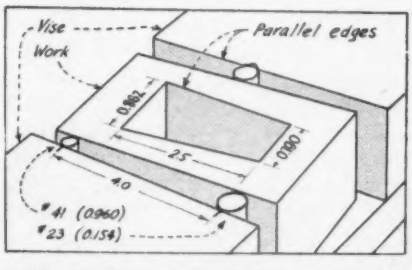
The example selected for illustration of the method was an actual job—a die. The slot was 2.5 in. long by 0.862 by 0.790 in. wide, or a taper of 0.346 in. per ft. $\left[\frac{0.862-0.790 \times 12}{2.5}\right]$ and the piece itself was 5 in. long.

In order to reduce the % error and to assure the best clamping, space two drillrods as far apart as the piece and the vise jaw will allow. In this case 4 in. is near the ends of the work (it's longer than the slot anyway) and it is a good even number. Measure this distance carefully and scribe two lines on the piece. (If you have to make quite a few, scribe the lines on the vise jaw instead; then you won't have to repeat this for every piece.)

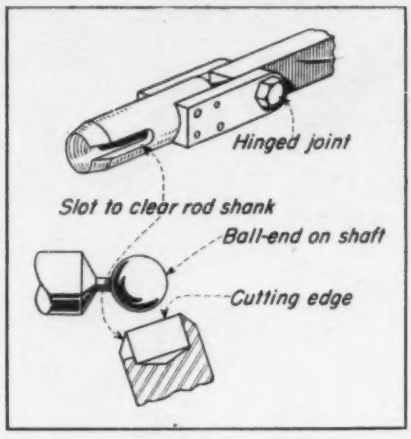
The taper is 0.346 in./ft., symmetrical to the straight parallel sides of the block, so each side of the slot tapers just ½ this amount, (0.173 in.) In 4 in. the taper would be 1/3 this amount, so the actual drillrod difference you want is 0.058 inches. Number 23 drillrod is 0.154 and number 41 is 0.0960 in. in diameter, giving a difference of 0.058 inches.

With the vise properly squared on the table and the part in place held with the three drillrods, the side of the slot to be cut will be *away* from the two rods when the *larger rod* is at the *smaller end* of the slot, but will be *near* the rods when the *large rod* matches the *larger end* of the slot.

For comparatively small tapers requiring good accuracy this method has been found more successful than any other I've tried.



Drillrod diameter difference cocks piece in the chuck at proper taper



For ball cutting in soft metal, the drillrod needs no hardening

Drillrod Tool Cuts Ball Ends On Knobs and Links

FRANCIS B. DIAL
Long Beach, California

If you want to put a ball end on a brass rod, in making a swivel-joint, for example, take a short piece of drillrod and bore a hole in one end with the desired ball diameter. Finish the tool by putting a slight chamfer on the cutting edge. The angle of the chamfer will depend on the material being cut. Mill a slot in one side wide enough to give the proper neck diameter.

For cutting balls on brass and aluminum the drillrod is hard enough as is, and a wooden handle and regular wood lathe technique will be satisfactory as the tool has no walking tendency. For harder materials, the drillrod should be hardened and the chamfer angle reduced. As power feeding will probably be required, a stub is added to hold the tool in the toolpost.

Altered Tube Fittings Meet the Deadline

A. KUDOLA
Springdale, Conn.

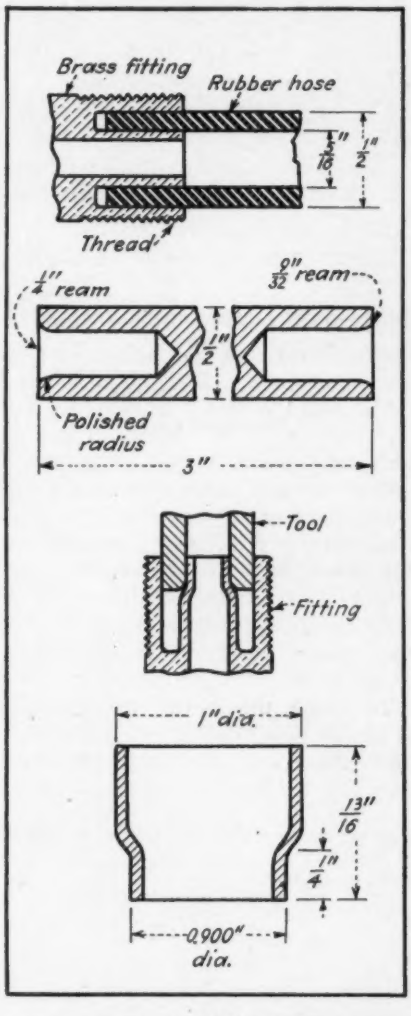
Design specifications called for rubber tubing ½ in. O.D. and 5/16 I.D. but we didn't discover until very near the delivery date that the tubing shipped to us had a ¼-in. hole.

The special chromium-plated brass fittings to which the tubing was to be attached had inside and outside walls so the reduction in tube I.D. made assembly impossible.

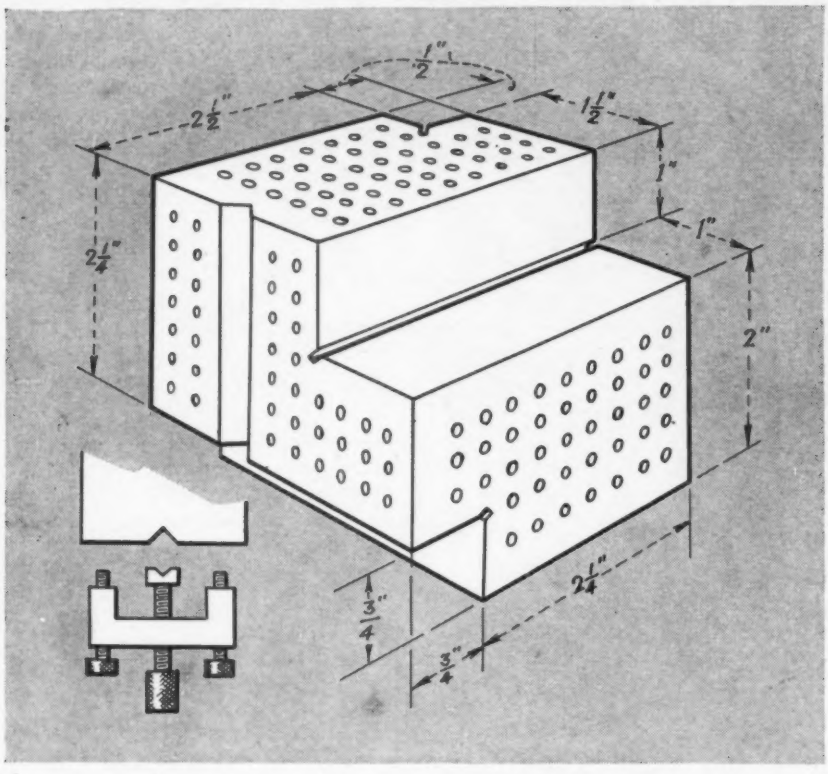
At the request of the sales department, we tried everything we could think of to enlarge the hole for a short distance, but to no avail.

The next step was a search for a way to neck down the inner portion of the fitting. We didn't dare anneal the metal because of the danger of damaging the chrome plating. The successful tool was a 3-in. piece of ½-in. diameter cold-rolled steel, drilled and reamed both ends, and finished with a polished radius.

The drawing or necking down was accomplished in an arbor press in two steps. One end of the tool had a 9/32-in. hole to reduce the sleeve down from the initial 5/16-in diameter. The other end, with a ¼-in. hole, finished the job.



Top, rubber tube and fitting assembly as designed; next, the double-ended tool for necking down; third, application of tool to the work; last, drawing 0.030-in. wall, 1-in. dia. tubing was successfully accomplished by similar means



This layout block can be used in any position. Often, work can be left attached and the block turned to make the various measurements

Heavy-duty Layout Cube Combines Angle Plate and V-Blocks

GEORGE MATTSON
New York, N. Y.

This cube is cut from 3 x 3-in. cold-rolled steel and three corners are cut away, making 90° vee of ½, ¾, and 1-in. square. A 90° vee is also cut in one face, 1 in. from the corner.

The block is ground until it's very close to square and holes are drilled and tapped 10-32 on ⅜-in. centers on all faces.

To finish the block, case-harden to about ⅛-in. depth, grind and lap until it's really square. Care here will pay for itself later, and a block that's little off is no good at all.

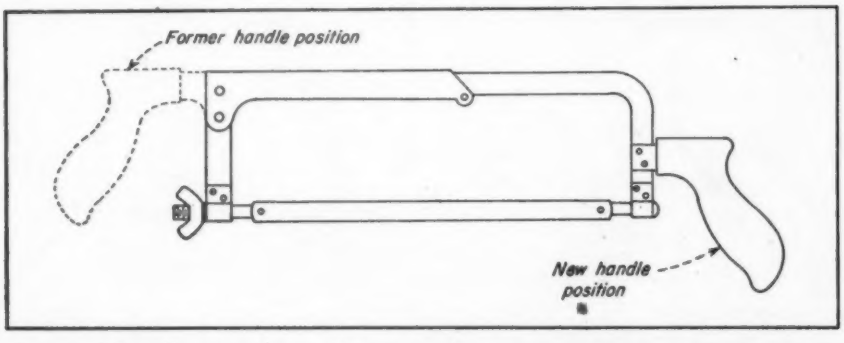
Various clamps can be made for use with the block to position flat or round work or to hold special gages.

Lower Your Hacksaw Grip For Better Cutting

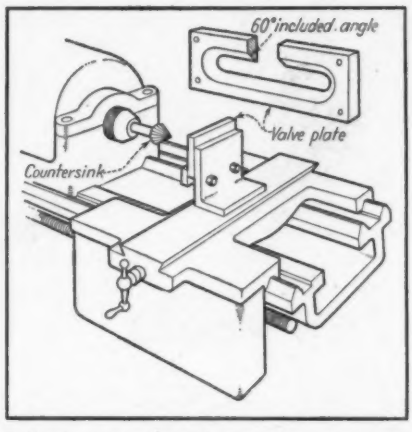
LAWRENCE H. SEIBERT
Little Silver, N. J.

As the blade and its frame may be considered a rigid body, the force applied to the handle will be applied to the teeth of the blade in the same amount and direction. Ideally, this force should be applied straight along the teeth, and not at any angle. With a standard pistol-grip hacksaw there is a turning couple because the pressure on the handle is parallel but not in line with the force against the teeth. Therefore, to control the saw, the wrist must exert a counter-torque in addition to the straight push, in order to keep both ends of the blade cutting equally. The resultant of this is a force directed slightly downward, and a tired wrist.

Noticing this difficulty, I cut off the pistol grip and mounted it adjustably (on the other end to clear the wing nut) and experimented until I found a place where there was no twisting tendency.



Lowered handle puts thrust directly in line with resistance and eliminates torque



Refacing a valve plate with a countersink in the headstock gave poor results until a rag accident saved the day

Old Rag Stops Chatter In Countersink Milling

L. H. LUKE
Syracuse, N. Y.

After the edge of a worn valve plate was built up by brazing, it had to be milled off to its 60°-chamfer around the slot. I had no milling machine so I took the compound off my lathe and mounted the plate vertically on a bracket and chucked a 60°-countersink in the headstock.

The first careful attempt at milling in this manner was spoiled by excessive chatter. Somehow, during this process, a piece of rag was caught under the cutter and before I could retrieve it, the rag was in shreds. Stopping the lathe, I noticed that the surface under the cutter was very smooth, caused apparently by some kind of cushioning action.

As I had already removed most of the stock, I continued the rag feeding and the final finish was very smooth with no chatter marks whatsoever.

How to Square Fractions

CARL P. NACHOD
Vice President
Nachod & U. S. Signal Co., Inc.
Louisville, Ky.

Rule I: The square of a number ending in $\frac{1}{2}$ is the product of the next smaller and the next larger integers plus $\frac{1}{4}$.

$(N\frac{1}{2})^2 = (N + 1)\ (N) + \frac{1}{4}$.

Example: Let N = 8. $(8\frac{1}{2})^2 = 9 \times 8 + \frac{1}{4} = 72\frac{1}{4}$

Proof: $(a - b)\ (a + b) = a^2 - b^2$

$a^2 = (a - b)\ (a + b) + b^2$

let $a = 8\frac{1}{2}$ and $b = \frac{1}{2}$

$(8\frac{1}{2})^2 = (8\frac{1}{2} - \frac{1}{2})\ (8\frac{1}{2} + \frac{1}{2}) + (\frac{1}{2})^2$

$8 \times 9 + \frac{1}{4} = 72\frac{1}{4}$.

Rule II: The square of a number ending in $\frac{1}{4}$ or $\frac{3}{4}$ is the product of number minus $\frac{1}{4}$ and the number plus $\frac{1}{4}$, all plus 1/16.

$(N\frac{1}{4})^2 = (N\frac{1}{4} - \frac{1}{4})\ (N\frac{1}{4} + \frac{1}{4}) + 1/16$.
$(N\frac{3}{4})^2 = (N\frac{3}{4} - \frac{1}{4})\ (N\frac{3}{4} + \frac{1}{4}) + 1/16$.

Examples:

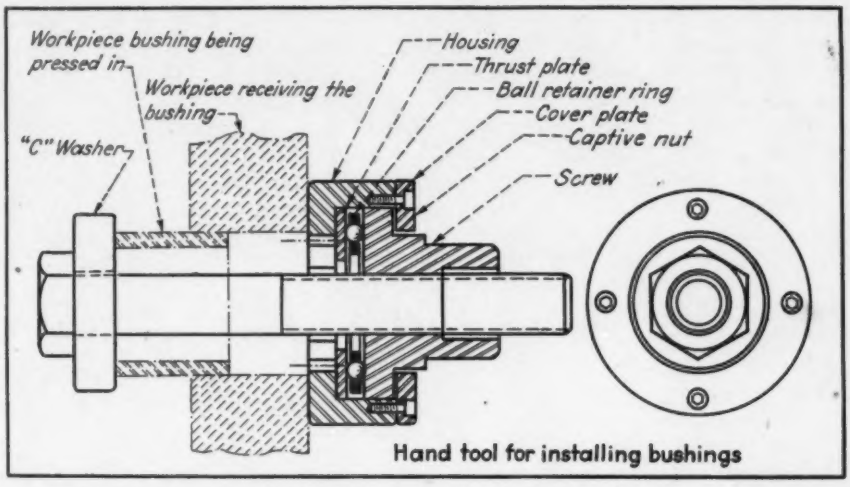
$(4\frac{1}{4})^2 = 4 \times 4\frac{1}{2} + 1/16 = 18\ 1/16$.
$(4\frac{3}{4})^2 4\frac{1}{2} \times 5 + 1/16 = 22\ 9/16$.

Rule III: The square of any 2-digit integer is the product of the next smaller multiple of ten and the number plus this difference, all plus the square of the difference. To put it another way, the square of *any* number may be broken down into the product of the next smaller *convenient* number and a number larger than the original by the same amount plus the square of this amount.

Examples:

$31^2 = 30 \times 32 + 1 = 960 + 1 = 961$
$34^2 = 30 \times 38 + 16 = 1140 + 16 = 1156$
$35^2 = 30 \times 40 + 25 = 1225$
$87^2 = 84 \times 90 + 9 = 7569$
$5\frac{1}{4}^2 = 5 \times 5\frac{1}{2} + 1/64 = 25\ 7/64$
$5\frac{3}{8}^2 = 5 \times 5\frac{3}{4} + 9/64 = 28 + \frac{3}{4} + 9/64$
$= 28 - 7/64 = 28\ 57/64$

I'd be willing to bet that if you take the time to figure this all out and play with it for 15 minutes, trying your own examples by this method and then by the regular longhand method, you will see that this is a great timesaver. A little practice will impress it on you so you won't forget easily. Many problems can be worked out in your head, and even the more complicated ones like the last example can be worked in a few steps on paper, which, if squared the usual way, would require the division of 1849 by 64.



Case-hardened nut and thrust bearing housing make bushing driving and other similar clamping jobs simple because of greatly reduced friction

Large Bushings Sensitively Installed in Close Quarters

HERBERT WEITZ
Union, New Jersey

Every erection machinist knows of the difficulties in installing large bushings or bearings on machine frames when the frames are in an advanced stage of assembly and a powered means of installation is impractical due to handling difficulties.

This hand tool, utilizing lever and screw principles, is compact and easy to handle. It has plenty of power but it affords sensitivity or "feel" because of the ball-thrust bearing behind the nut.

The only element in the tool requiring any machining is the nut and housing assembly with the built-in thrust bearing. A standard hex-head machine bolt, and an open-side "C" washer complete the tool. The nut is case-hardened so most of the wear will be on the bolt threads, and when the bolt wears out it can be replaced readily. The housing and cover enclose the bearing to prevent entrance of dirt and to keep the parts together. A standard three-piece ball-thrust bearing can be bought to fit, or one can be assembled quickly. As the nut is case-hardened, only one thrust plate will be needed, and the retainer in this case need only be a spacer for there isn't enough end play to allow the balls to drop out.

After the housing and nut have been machined, assemble the parts and chuck the housing in the lathe. Bring the tailstock up against the nut and start the lathe, thus rolling in the ball races under pressure. They can then be hardened.

Knockout holes are provided in the housing to remove the thrust plate when and if necessary. The "C" washer and housing body should be knurled so oily fingers can get a good hold. The nut is clearance-drilled half way down as all that extra thread would only mean added friction.

To assemble a bushing, set it in position and poke the bolt head through the hole in the machine and bushing until the "C" washer can be dropped in place. A few finger turns will bring the nut up tight and a wrench will drive the bushing home.

How to Measure the Radius Of a Short Circular Arc

JAMES VAN VOAST
Assistant Editor

Question: *I would like to know how to find the radius of a circular arc (like an iron brake shoe) using three rolls of equal diameter.—Ed. Kuchar, Ithaca, Michigan.*

Answer: After mulling this one over for some time, we decided that a depth gage would provide the best solution for all cases. All you have to do is measure down from the tangent to the two outer rolls to the highest point on the center roll. A

little pressure on the gage head will keep the three rolls in contact and the old reliable "feel" will give a good measurement.

It is better to select rolls as large as will fit the groove (if the depth gage won't span the rolls alone, use a parallel, and taking its thickness into account, measure down from it) in order to get a large reading, reducing the % error, but, of course, any rolls will work if they fit into the curve.

The formula which gives the relationship between the known and the unknown circles is based on similar triangles and provides a fairly simple method for solution. If this problem is encountered frequently, a table or nomograph could be constructed making all solutions instantly available.

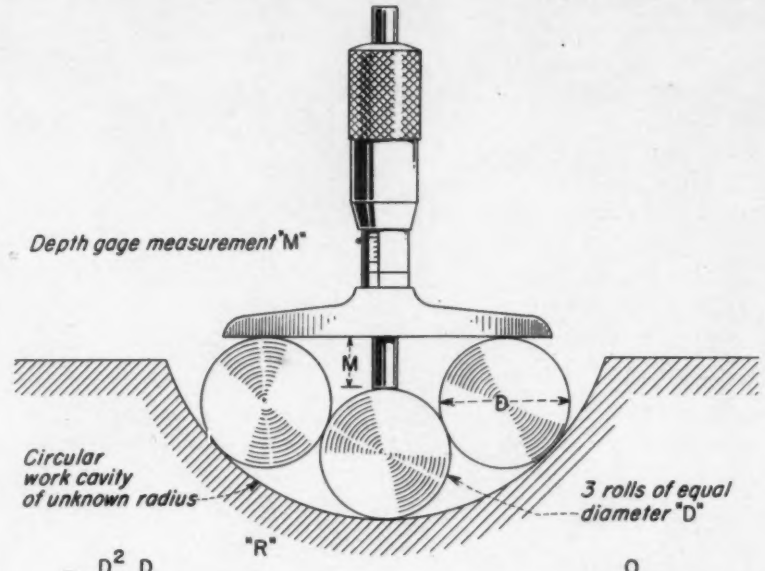
To illustrate the effect of 0.001 in. error, using 1-in. rolls and unknown grooves of large and small radii, here are four solutions:

$$M = 0.357 \quad R = \frac{1}{0.714} + 0.500 = 1.9006$$

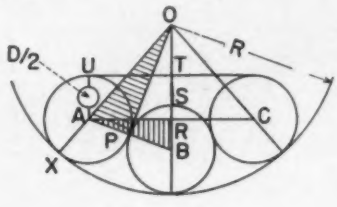
$$M = 0.358 \quad R = \frac{1}{0.716} + 0.500 = 1.8967$$

$$M = 0.019 \quad R = \frac{1}{0.038} + 0.500 = 26.81$$

$$M = 0.020 \quad R = \frac{1}{0.040} + 0.500 = 25.50$$



$$R = \frac{D^2}{2M} + \frac{D}{2}$$



EXPLANATION:

Circles A,B,C, equal	(given)
UA = AP = AX = PB = BS = D/2	(radii)
M = TS = BR	(TS = D/2 − SR)
Angle ARB = angle OPA	(rt. angles)
Angle OBA = angle OAB	(isosceles)
Triangle OPA similar ARB	(equal angles)

$$\frac{OA}{AB} = \frac{AP}{BR} \qquad \frac{R}{D} = \frac{D/2}{M} + \frac{D}{2} \qquad \boxed{R = \frac{D^2}{2M} + \frac{D}{2}}$$

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Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. The decision of the readers will be final in each case.

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Seventeenth Selection—S. Framury on Locating Opposite Faces

Cylindrometer for Measuring Large Diameters—I

PROF. DR. ING. N. N. SAWIN

AS IS WELL KNOWN, the diameter of an object can be found by measuring the length of the tangent corresponding to a definite central angle. In this case, the length of the tangent will be in constant ratio to the size of the diameter. If this ratio is known, after measuring the tangent, the diameter is found either by the aid of simple multiplication or may be read on a measuring instrument. Thus, diameters of small pieces are measured, for instance wire, when great precision of measurement is not required.

The described instrument, meant for precise measurement of large pieces, is shown on Fig. I. The instrument is composed of an angle-like body 1, formed by two equal tangents with the point of intersection in the center of plug 9. On one of these tangents there is a slide 2 with the micrometer screw 4. On the slide there are two equal indicators 3 at distance *a* from one another.

The angle-like body is put on the measured piece, and the slide is moved until both indicators show the same measurement. At this location the point of contact of the tangent with the piece lies equidistant between the indicators. Previously, the slide is set up with the aid of slip gages at a definite distance between the flat end 7 of the micrometer screw and the plug 8. In this original position, the nut 5 of the micrometer screw is fastened to the slide by the screw 6 and the vernier of the micrometer is set at zero.

The established length is equal to the length of the measured tangent minus the half-diameter of the plug 8 and minus the distance *b* between the flat end of the micrometer screw 7 and the point of contact of the tangent with the surface of the measured piece. Within the length of the micrometer screw it is possible to measure diameters with little deviation from the value of length established by the aid of slip gages; otherwise a new setting is needed. The reading on the micrometer is added to the length of the tangent established by the aid of the slip gages. This value is multiplied by the constant of the instrument, expressing the ratio of the value of the measured diameter to the length of the tangent. The angle between the tangents is chosen to get a simple ratio, like 3, 5 and so on.

In order to make the instrument meet the needs of high precision measurement, it is necessary that the length of the tangent in comparison with the value of the measured diameter be as great as possible. For that reason the angle between the tangents should be as sharp as possible. Therefore, the instrument is very large.

This defect is overcome in a variation of the cylindrometer, shown on Fig. 2. Here the angle-like body consists of a short constant tangent *C* with two indicators 3-3 and the arm 1 with a moving slide 2, the end *B* of which is moved along the straight line *BA*, cutting the tangent

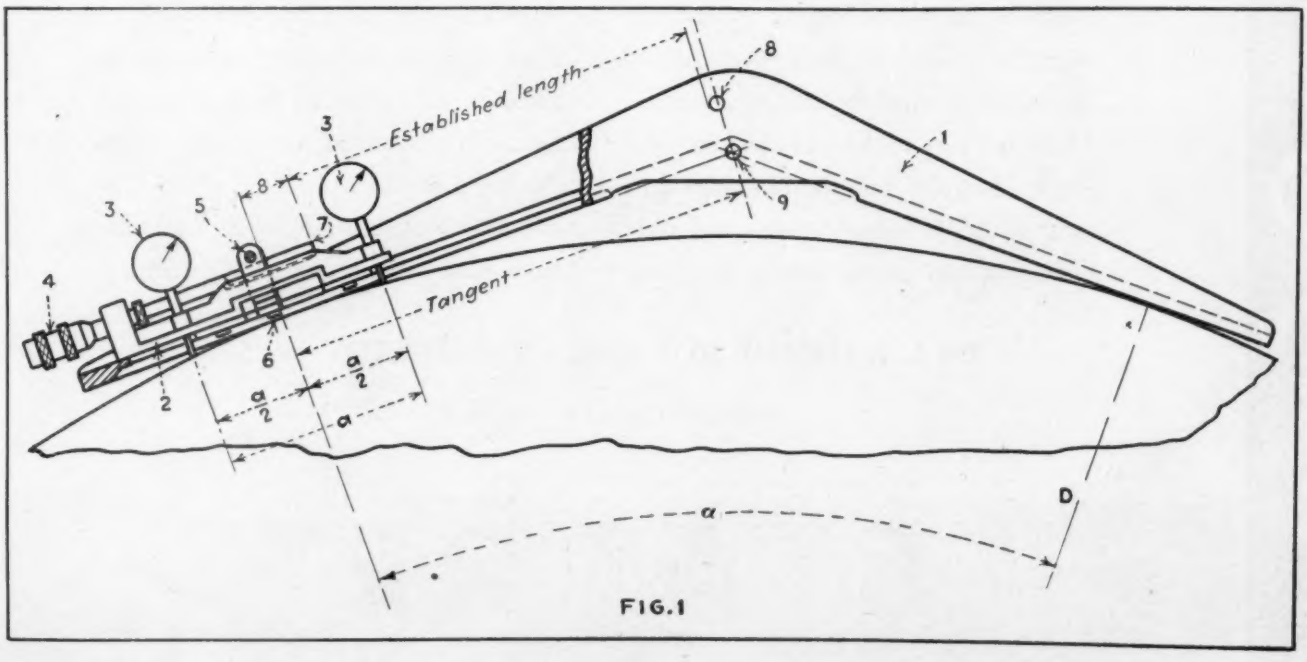
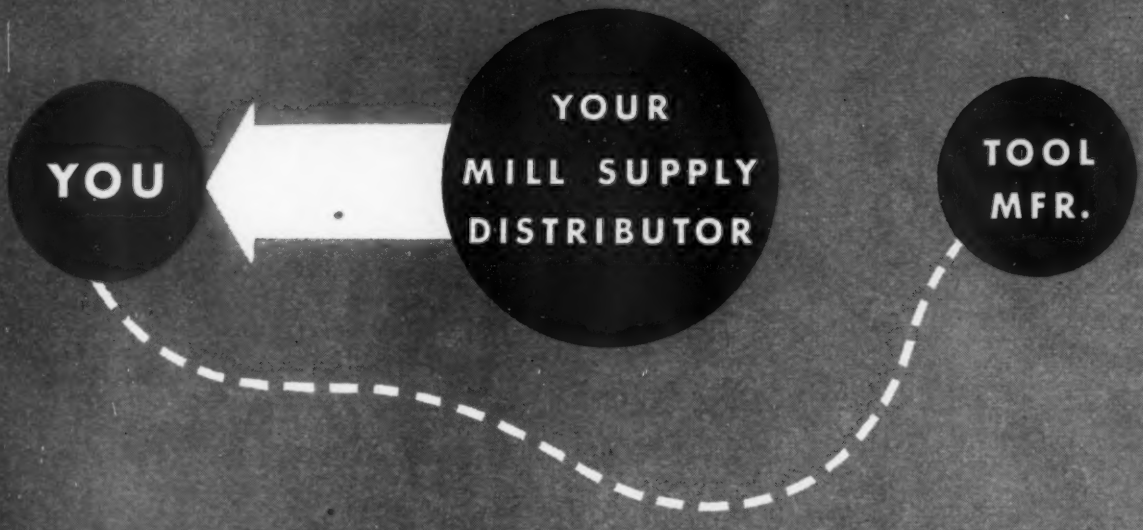


FIG. 1

STARRETT TOOLS

TAKE THE SHORTEST ROUTE TO THE TOOLS YOU NEED



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Cylindrometer for Measuring Large Diameters—II

at its point of contact *A* with the surface of the measured piece. The straight line *BA* (the chord) corresponds to a definite and unchangeable center angle α; therefore its length is in a constant ratio to the diameter of its circle:

$$BA = D \sin \frac{\alpha}{2}.$$

In use, the instrument is set on the piece and the slide 2 is moved by the aid of the micrometer screw until both indicators 3-3 show the same value. In this position the tangent *C* touches the surface of the piece at its point of intersection with the straight line *BA*. Thus the required condition of constant ratio between the dimensions of the diameter and the chord is attained.

By the aid of the micrometer screw the length of the chord *BA* is measured directly after the distance between the reference piece 7 and the button 8 is determined by the aid of a slip gage. The instrument is meant for measuring diameters of large pieces in the same large intervals, as in the variation with two tangents, for instance, within 500-1100 mm., 1000-2000 mm., 1900 to 3500 mm. and so on, but its length and, consequently, its weight is considerably less. For example, Fig. 3, an instrument for measuring diameters from 1900 to 3500 mm., has a length *L*, in case of the second variation (measuring of the chord), about 900 mm. against 1500 mm. by the first variation (measuring of the tangent).

The described types of the measuring instruments can be applied for measuring diameters of the pieces on the machines both when horizontal (as on lathes) and vertically (on boring mills) as well as in the inspection department. The principles of the cylindrometers have been patented in different countries.

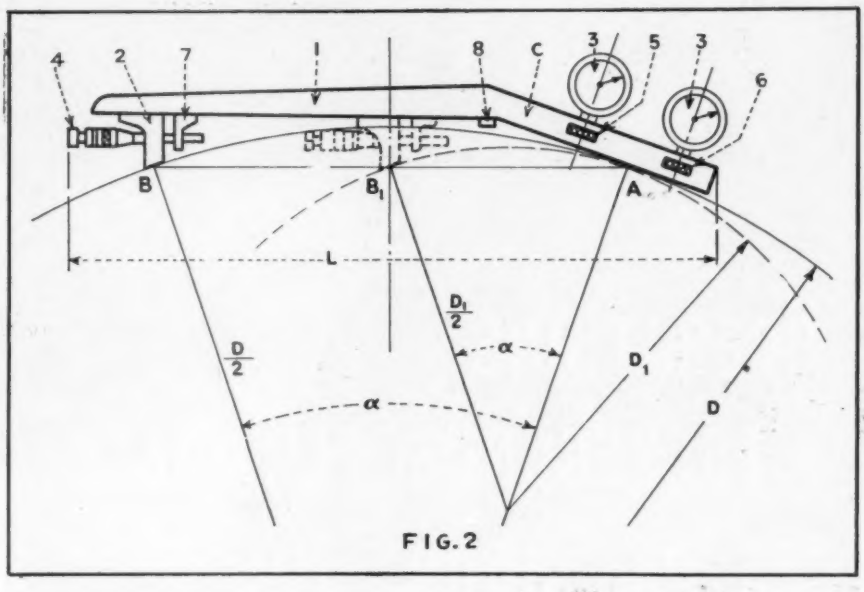


FIG. 2

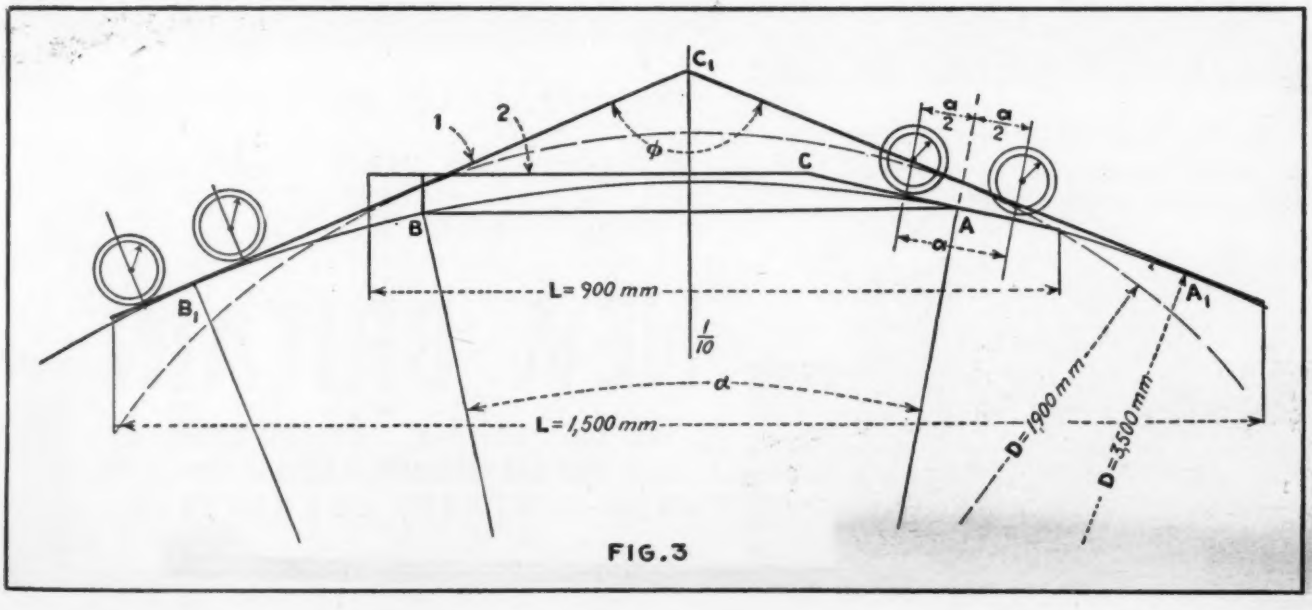
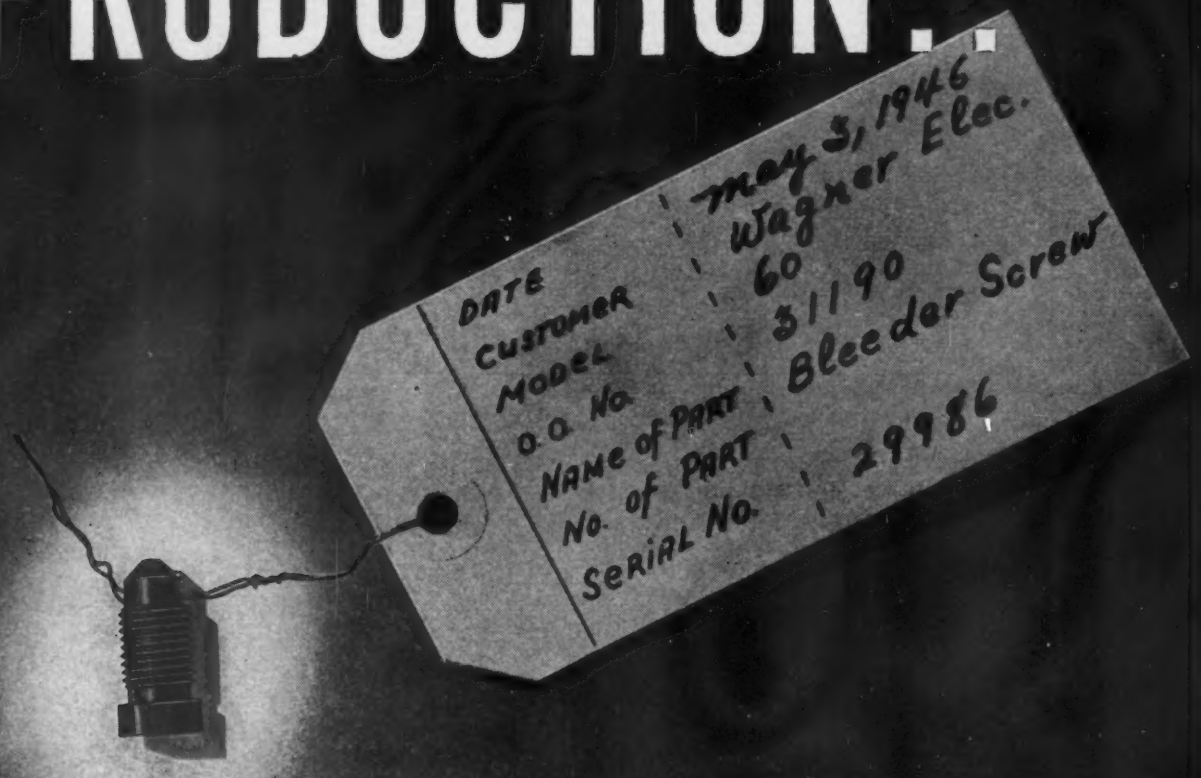


FIG. 3

PRODUCTION.



6 OPERATIONS
4.15 SECONDS PER PIECE
869 PIECES PER HOUR [AVERAGE]

New Britain Model 60 Multiple Spindle Automatic Screw Machine on which the part shown above is machined.

For more, better parts per hour this year and years from now, it pays to pick

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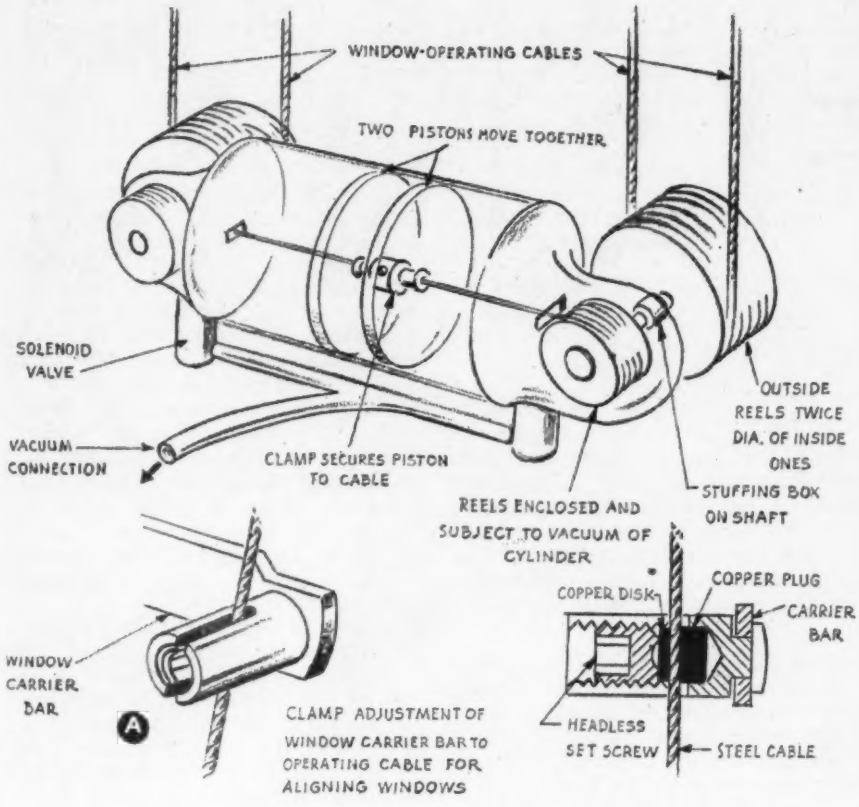
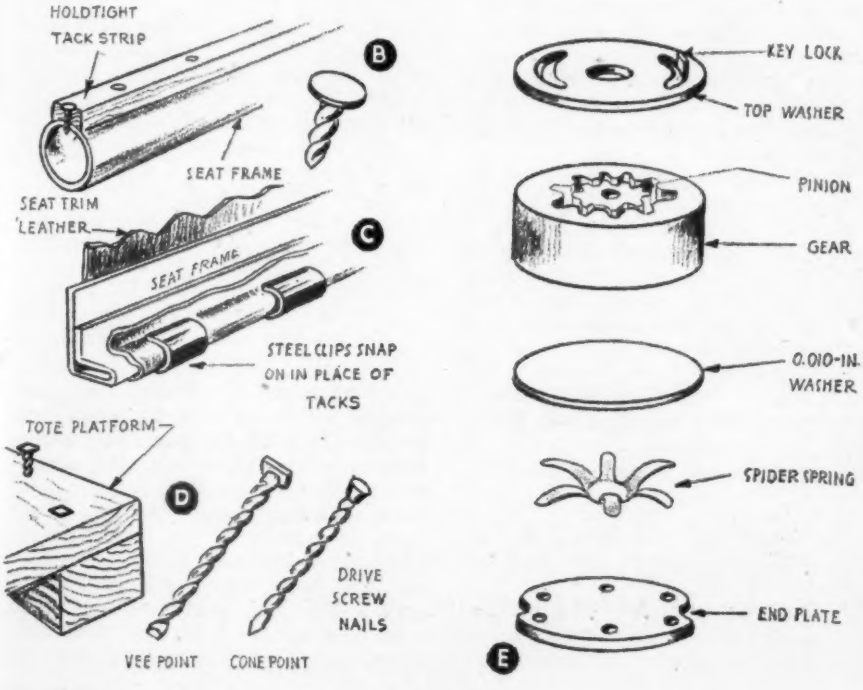
WHAT'S NEW IN AUTO BODIES

Chester Ricker, Detroit Editor, sketches at the meeting of the American Society of Body Engineers





(A)

Window Operator—A 2-way switch raises or lowers windows in 1 to 5 sec. by vacuum with this unit. It has a welded and broached oval steel cylinder, burnished to size and finish. Pressed-metal pistons have rubber seals; the piston "rod" is a steel cable which leads to reels inside die-cast zinc heads. Reel shafts go through stuffing boxes to double-dia. outside reels that carry window-operating cables. To operate rotating venti-panes and the new hinged rear windows, the regular windshield-wiper unit is lengthened 5 or 6 times. —*Trico Products Corp., Buffalo*

Glass run channels just introduced develop *less* friction under ice or water, instead of *more*—a previous serious problem with automatic window regulation—*General Rubber Co.*

(B)

One-operation Seat Assembly — "Holdtight" tack strips are fastened to tubular-steel seat frames without drilling holes or using bolts or rivets. Sharp-pointed helix-shanked drive tacks are driven by machine.—*Hillwood Mfg. Co., Cleveland*

(C)

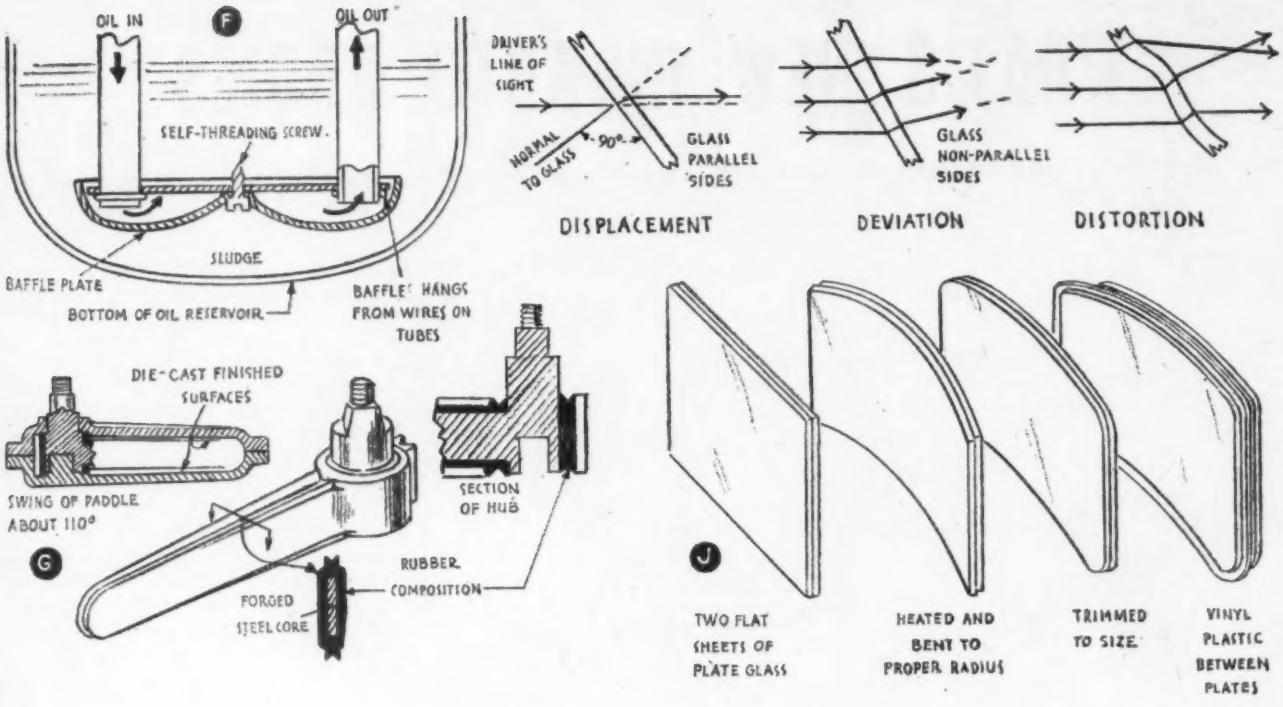
Seat-fabric Clip—Upholstery material can be attached to the metal seat frame with steel spring clips. The material is tightened around the frame rod inside and the clip snapped over the edge. The same company has a tubular front-seat frame design for trucks in which the frame itself is a hydraulic-oil reservoir for an attached hand pump to shift seat height.—*Stubnitz Green Spring Corp., Adrian, Mich.*

(D)

Screw Nails—High-tensile square manganese-steel wire twisted into a helix and headed, then heat-treated, forms nails which may be driven tight. They were used for ordnance boxes during the war, now hold planking on skids. Several head forms and point types are provided. The V or chisel point is claimed not to split wood as a cone point does, and can be tightened by hammering as green wood dries. The cone point attaches wood or steel sheet to another steel piece or concrete (will penetrate the latter ½ to ¾ in.). —*Hillwood Mfg. Co., Cleveland*

(E)

Hydraulic Operator—This simple, low-cost hydraulic pump compensates for temperature variations under which a car operates. It is a



cycloidal unit, with pinion inside an internal-ring gear (both unmachined, sintered powder-iron). A copper-alloy disk with punched ports, keyed to prevent turning, is the top bearing. A 0.010-in. disk holds the gears from below, backed by a star-shaped steel spring that bears against the housing end plate. The spring allows for axial gear expansion, the thin washer for slight differences in gear-face finish. The housing itself is an unmachined zinc die casting.

The pump powers a cylinder to raise a window, which is lowered by a spring. A solenoid valve in the window-operating cylinder opens to release pressure during lowering, stays closed to hold the window up. Synthetic rubber forms the valve disk (against a die-cast zinc seat) and also the piston disk. Hemispherical buttons at the ends of the lifting unit give it play as the linkage shifts in window operation and simplify installation. In the bottom of the oil reservoir is an unusual baffle (sketch F), which avoids stirring up sludge or dirt which may have settled.—*Dura Div., Toledo*

(G)

Hydraulic Lift—A motor-pump with attached oil reservoir, controlled by two remote-controlled solenoid valves (like those common for self-starter switches) — one for each direction—powers this window actuator. Body halves are zinc die castings with no inner-face machining, yet the rubber-covered actuator paddle seals at pressures to 250 psi. Paddles are steel forgings, with both arms and hubs covered with molded rubber that has a V-shaped groove around the sealing surfaces. The same company proposes cylindrical actuators for convertible tops, the hood, the rear trunk deck, and to shift the driver's seat—all served by the same pump.—*Motor State Products Co., Ypsilanti, Mich.*

(J)

Curved Safety Glass—Curved safety-glass windshields offer optical problems in manufacture and in use. Body designer and automotive engineer must work together to place the driver so his eye is in proper relationship to curvature of the shield, or displacement problems increase. Proper curvature and size are important. Deviation and distortion are caused by non-uniform glass also, so special methods must be used in manufacture. Mechanical problems are presented also, in installing, and in application of windshield wipers.

New practice is to work plate-glass sheets in pairs, separated by a powder lubricant to prevent sticking. They are heated and bent to proper curvature by gravity. Ends are then cut to match and edges ground. Vinyl plastic sheet is laid between the cleaned sheets and the assembly placed in an autoclave for integration. Finished windshields must meet ASA Safety Code Z26.1-1938.

Five classes of bends are made in glass:

I—Those which can be cut to pattern, then bent in skeleton molds.

II—Bent on skeleton molds, then cut to pattern with considerable waste of glass (sketched).

III—Made in thin-metal molds contacting the entire surface. An extra sheet of glass must be placed between lower glass plate and mold to preserve glass finish, and discarded thereafter.

IV—Bent on ceramic molds contacting entire surface. These require an extra glass plate as in III and also are cut to size after bending, increasing scrap.

V—Intricate curves requiring two or more of the preceding processes and a corresponding number of lehr cycles.

There are also three main types:

A—Approximate sections of cylinders and cones not over 6 in. deep and 30 in. radius max. Shapes must be generally rectangular, with ends parallel to the axis. Length of arc must not be over chord plus 2 in.

B—Spheroidal shapes not more than ¾ in. deep along the short dimension, where exact surface contour is not essential.

C—Cylindrical or slightly conical curves of 20-in. min. radius with flat tangent sides of equal length.

Class I and II bends cost about twice as much as similar flat-glass shields, the most complicated forms as much as 25 times more. Glass weighs twice as much as the metal panels it replaces—so increase in glass will increase car weight. Sun heat transmitted by uninsulated glass areas increases heat inside the car, may force venetian blinds or equivalent accessories.—*S. Frank Cox, director of research, Pittsburgh Plate Glass Co.*

Industrial Machinery Exports Set a Record

By JOHN D. WILSON

ECONOMICS STAFF, MCGRAW-HILL PUBLISHING CO.

INDUSTRIAL MACHINERY has become No. 1 item on the U. S. export list, with foreign shipments climbing to a new peacetime peak.

Machinery exports through July were $487 million, or at an annual rate of $826 million—almost four times that of 1938. In fact, the total compares favorably with the war peak, $806 million in 1943, and $862 million in 1944. Export of all U. S. merchandise has been at an annual rate of about $9.5 billion—three times the 1938 total. Industrial machinery is slightly more than 9% of the aggregate.

Largest machinery exports (in terms of value) are engines, turbines and their parts. Shipment of these items grew greatly during the war, now accounts for more than a third of total export of machinery. In 1938 it comprised less than 5% of the total.

Machinery Declines

Export of metalworking machinery (chiefly machine tools) has declined greatly in relative importance; nevertheless this year's value (87 million for six months) exceeds that of 1938 by more than 50%. Recently these products have made up about 20% of the aggregate value of all machinery shipment; before the war they accounted for 40% of the total. Shipment of metalworking machinery reached the extraordinary peak of $271 million in 1944.

Export of mining, well, and pumping machinery also has dropped relatively, accounting for about 12% of the total, as against a former 23%. Nevertheless, shipments over the first half of 1946 were at an annual rate of $110 million, half again as much as in 1938.

Construction and conveying machinery has become a very large export item, although shipments are little more than half the record of $118 million in 1944 (chiefly to Russia and Britain).

Textile, sewing, and shoe machinery also has gained in importance as an export item with shipments more than four times the pre-war rates.

Europe is now talking about half of the U. S. industrial machinery moving abroad; the great bulk of it going to France and Russia. Canada is the largest neighboring market, although a ninefold increase in sales since 1938 (now at an annual rate of about $60 million) has made Mexico a principal customer. Brazil is the largest customer in South America, with sales running seven times the 1938 value. Venezuela also is a heavy buyer, particularly of mining, well, and pump machinery. Argentina, on the other hand, is purchasing little more today than in 1938.

Machinery exports to Asia are smaller than in pre-war days, principally because of disappearance of the Japanese market.

France and Russia Take Turbines

Exports of engines and turbines in the first six months of this year were $132 million. By far the largest purchases (65 million in first half, 1946) were by France, with the help of U. S. credits that now total $1.9 billion. Russia has also been a heavy buyer, with Jan.-June imports at $27 million. Current export of engines and turbines to Russia is small, however, compared with the 1944 value of $142 million (entirely on a lend-lease basis).

In the Western Hemisphere, Canadian import of engines and turbines at $8.5 million (for the Jan.-June period) is larger than that of any other country. Mexico and Brazil are other good customers, with purchases totaling $4½ million and $6 million respectively.

Metalworking Machinery

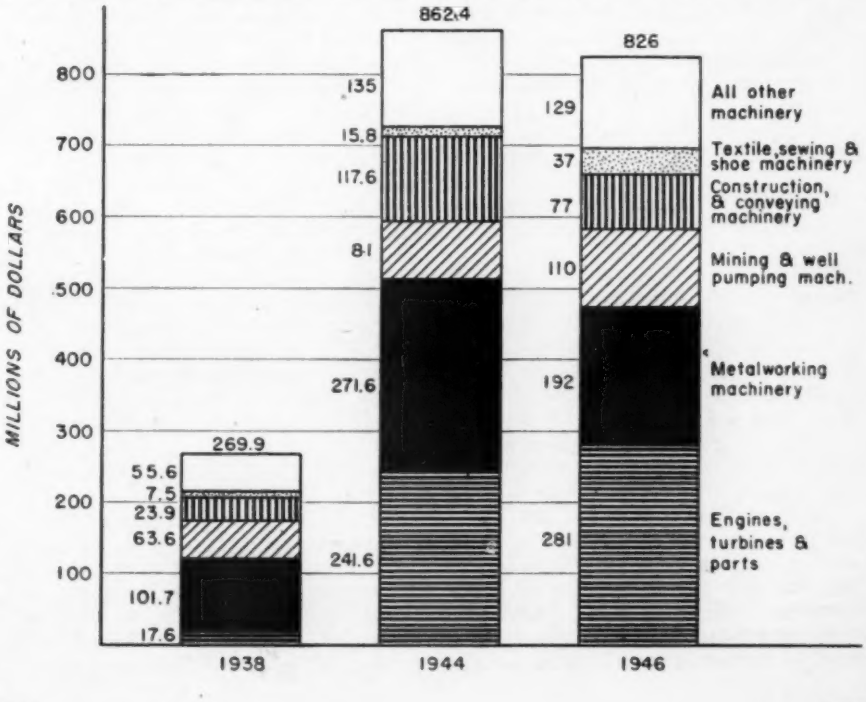
Russia has been the heaviest buyer of U. S. metalworking machinery. Shipments to that country during the first six months were $25.6 million. While this is greater than in the comparable period of 1938, it is small when contrasted with $345 million lend-lease shipments during 1943 and 1944—far in excess of the entire machine-tool production of this country in 1938.

France, with a purchase of $18.5 million of metalworking machinery in the first half year, also has been a large buyer. Shipments to France over coming months are expected to remain heavy, for the French possess funds to buy in the U. S. and lack exchange for buying in the United Kingdom.

Britain apparently is producing for itself most of the machine tools it requires, for U. S. exports to the British Isles have been only half the 1938 value (4.3 million, Jan.-June). Here again wartime shipments were extremely large, totaling $356 million from 1941 through 1944.

Big customers for metalworking machinery in the Western Hemisphere are Canada, Mexico and Brazil. Shipments to Venezuela and Colombia are much heavier than in pre-war days, but they do not bulk

EXPORT OF INDUSTRIAL MACHINERY—1946 ANNUAL RATE



large in the total export shipments.

The big hole in Asiatic markets of course is Japan, to whom an average of $25 million of metalworking machinery was shipped each year from 1938 to 1941.

South America Buys

South America is the big buyer of mine, well and pump machinery. Shipments in the first six months were more than those for the entire year of 1938, and more than double the total to Europe.

Venezuela, with a $10.8 million import of such machinery during the Jan.-June period, leads all other countries. Colombia, Brazil, and Peru have provided other markets. Canada (8.7 million) and Mexico (2.9 million) are the chief importers in North America, while Russia furnishes the principal market in Europe ($7.8 million).

Prior to the war, Asia was one of this country's best customers for mine, well, and pump equipment. Iran and the Netherlands East Indies spent $4 million each on these items in 1938, and the Philippines spent $2 million. But today none of these countries has taken much machinery of any kind from the U. S.

During the war years, shipments of mining, well and pump equipment to Russia were very large—$49 million in 1943. In spite of these heavy shipments, the flow of such supplies to South American countries, and to Canada and Mexico, were maintained at a rate which equalled or surpassed that of 1938.

One general line for which North America provides the principal market is construction and conveying machinery. Canada received $9.6 million of such equipment from Jan. through June of this year, while exports to Mexico were valued at $4.5 million. Brazil is the largest South American market for this machinery and France the chief European importer.

Lend-Lease Shipments

Here again the wartime record is of interest. U. S. lend-lease provided Russia with $75 million of construction and conveying machinery in 1943-44, while Britain received shipments valued at $96 million. Exports to Britain and Russia now are at an annual rate of about $3 million each.

Another significant export advance is the fourfold rise in shipments (as compared with 1938) of textile, sewing, and shoe machinery, to a total of $16.4 million for first half, 1946. Prior to the war the U. S. sent abroad very little of this equipment. But in the Jan.-June period, Argentina, Brazil, and Colombia stepped up purchases to almost one million dollars each. Mexico is another heavy buyer, with six month imports valued at $2.3 million. Shipments to Canada are slightly ahead of the prewar rate, as are also those to France and Britain. The latter countries are expected to increase their buying of this equipment through use of U. S. loans.

Competition with the British

Britain is the only large producer of machinery for export now competing with the U. S. Because of its dire need for foreign exchange to purchase essential foodstuffs and raw materials, Britain has been conducting an intensive export campaign, diverting output of many commodities to export markets.

This campaign has met with a greater success than anticipated. Total exports in recent months have exceeded those of pre-war days, both in value and volume. Moreover, machinery has been a spearhead. In the first six months, shipments totaled $188 million, largest among all exports. (The British include some electrical equipment in this machinery aggregate, a fact that must be remembered when drawing comparisons with U. S. statistics). This total stood 50% higher (in value terms) than in the comparable period of 1938.

Prior to the war, about half of the British machinery exports (including all types) went to the Empire, particularly to South Africa, India and Australia. The other half went to non-empire countries, of which Russia, the Netherlands, and Japan were large customers. Thus Britain concentrated on markets of less importance to the U. S.

In the first half of the current year, this same tendency to concentrate on different markets has been apparent. About 55% of British machinery exports have gone to Empire countries, with India now taking twice the amount of South Africa, the second largest purchaser. Shipment of British machinery to France, Russia, Canada, Mexico and Brazil—chief U. S. customers—has been small in both volume and value.

Textile machinery and other equipment for producing consumer goods bulk much larger among British exports than among U. S. shipment. British export of textile machinery alone amounted to $25 million in the first half of this year, up 50% from 1938. Britain appears to be taking over former German markets on the continent for this item.

British machine-tool exports for the Jan.-June period were valued at approximately $15 million. While this represented an increase of about 75% in value over 1938, the rise on a tonnage basis was only about one-sixth. In this one field, Britain has expanded shipments to France very greatly, although U. S. export of machine tools to the French still run almost four times those of Britain. This margin soon may be further increased.

British export of mining machinery today is less than in 1938, but shipment of pumps is larger. Export by Britain of engines and turbines also is heavier, although these products do not occupy the important place on the British export list they do on that of the U. S.

Future of U. S. Machinery Exports

Although machinery long has been a principal export of the United States, the importance of foreign markets to U. S. producers probably will be greater in coming years than ever in the past. The war brought a substantial expansion in capacity for producing most types of mechanical equipment, and the amount of that capacity which will continue in production over the longer term rests in no small part on the future export market.

The present level of machinery export is not likely to continue indefinitely, for it is based on large-scale U. S. loans. France and Russia (whose lend-lease funds now are running out) fall in this category. Moreover, Canada, Mexico and Brazil now are experiencing a period of relatively good business conditions, which their equipment purchases reflect.

Necessary Conditions

Even though the export of machinery falls below its present volume, it may continue to exceed the volume of the late thirties. To do so, however, certain conditions are necessary. The more important are:

1. Continuation of lending to countries in need of capital development. The World Bank affords the best opportunity for future lending on a large scale.

2. Maintenance of a high level of employment and industrial activity in the U. S. and Great Britain. If these two countries (and particularly the U. S.) continue prosperous, many other nations that might buy capital equipment will follow suit.

3. A long-run solution to the German and Japanese problems so these countries will not act as drags on the standard of living of their neighbors. Western Europe and Scandinavia, in particular, have had close economic ties with Germany, and a poor Germany will make it impossible for these areas to regain and surpass their former level of economic well-being.

4. A greater measure of political stability. Russia (which took more machinery from the U. S. than all of South America in 1938) and China should be two of this country's largest customers.

NEWS OF METALWORKING

Question of Future Legislation Follows End of Paralyzing Strike

NEW YORK—The abrupt end on Dec. 7 of the paralyzing 17-day walkout of bituminous coal miners permitted all industry to roll down the curtain on a year punctuated with production handicaps and face the new year with renewed hope for a smoother road toward operational achievement.

An outstanding aftermath of the coal strike involves the imminence of legislation by the new Congress to prevent recurrence of such far-reaching breakdowns in the nation's economy. While the strike was of less than three weeks' duration, it demonstrated distinctly how it could bring all industry to a virtual standstill.

Spotlight on Labor Relations

Industry will watch avidly in the months ahead for a solution to the question of relations among labor, industry and the government. The coal walkout climaxed a crisis in labor-management relations. Critics of the National Labor Relations (Wagner) Act have demanded revisions which would give management the same rights as labor. A tempering note was sounded in some quarters seeking to avoid turning the act into an anti-labor law.

Fortunately, John L. Lewis' surprise action in calling off the strike prevented full impact of the freight embargo. The government moved swiftly to remove restrictive coal-conservation measures and restore transportation to pre-strike operations.

Crippling Effects Will Show

Nevertheless, the strike precipitated situations which will not be cleared up rapidly. For example, curtailed operations in steel mills and automotive plants threw schedules out of line. Cancellation of major tooling orders by Chevrolet for 1948 models followed close on the heels of the strike and it remained a question at this writing what decisions the strike's end will bring.

RESTRICTED AUTO SALES LOOM IF COSTS ADVANCE

NEW YORK—Immediate problem facing the automotive industry is how to attain increased productivity which will validate past wage increases, stated B. E. Hutchinson, chairman finance committee Chrysler Corp., in addressing members of the National Association of Manufacturers. Automobile prices cannot be stabilized at current levels if costs are further increased by granting additional wage rises. Ultimate effect of further price advances will be to restrict car sales, which are sensitive to price changes.

High absenteeism and excessive labor turnover have contributed to reduced worker productivity, said Mr. Hutchinson. In 12 months ended Sept. 30, more than 73,000 man-years of work were lost through strikes, or the equivalent of a full year's production by Chrysler Corp. Inability to get capacity production now results not only from strikes, but from government regulations, allocations and priorities.

Builders Check Surplus Machines In Plan for Military Stockpiles

WASHINGTON — Regional committees of machine tool builders have been formed to find out from all the builders what surplus machines of their own make should be retained for emergency purposes by the government and to try to locate those machines. Recommendations will be made to the Army and Navy Munitions Board which is working on an estimate of the reserves needed by the services.

When data on reserves are compiled, a report will be made to Steelman of OWMR, who ordered the study. Navy officials scout reports the services will need an appropriation to buy the tools which they may be authorized to put in reserve. They believe a bill will be introduced in Congress authorizing the services to take title to the tools.

Such a reserve of machine tools could be set up parallel with, or within the critical materials stockpile, or it could be an entirely separate organization. A pool for all the services logically could reserve more machines than separate service pools. The reason is that it costs money to maintain such reserves in storage. These costs would come out of appropriations to Army and Navy, and they will have plenty of trouble getting funds as it is. This might also serve to limit reserves.

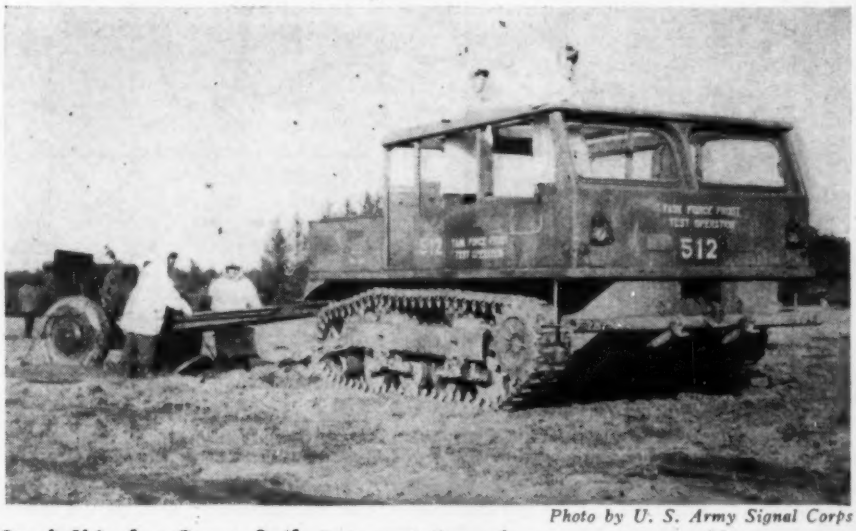


Photo by U. S. Army Signal Corps

Steel Skis for Guns—Swift transportation of guns across muddy or snow-covered terrain can make the difference between win and lose in battle. The Army finds that by mounting guns ranging up to 155 mm. on steel skis with reinforced edges, they can be towed by tractors over sloppy ground that would bog down wheels. A 75 mm. gun is shown being towed

Gaging Business

Resumption Will Be Speedy

The sudden and dramatic end of the coal strike just saved the metalworking industries from halting operations. Many layoffs already had been made and some complete shutdowns had occurred, principally because of the freight embargo imposed to conserve coal. Resumption of operations will be a relatively quick process, though after-effects of the coal strike will sharpen the difficulties of getting materials and parts.

Steel Tonnage Down

Key to most metalworking activities these days is the steel supply. Every ton lost as a result of the coal stoppage means that much less production of finished goods. And considerable tonnage was sacrificed during the latter days of the strike. These constant interruptions increase greatly the costs of production and make substantial savings virtually impossible. Though the end of the coal strike has its cheering aspects, steel users are viewing apprehensively the coming wage talks between steel companies and the CIO and are weighing the possibilities of a steel strike similar to the one early this year.

Castings Are Bottleneck

Materials shortages of all kinds continue to plague most metalworking firms. Castings again are the biggest bottleneck in the machine tool industry, with the situation especially acute in New England. Electrical equipment, particularly motors, is short and in some cases will hold up completion of large machine tools three and four months.

Orders for electrical equipment, in fact, are increasing and backlogs are swelling. Though production is averaging about three times the prewar rate, sales are four times the prewar volume. Backlogs range from seven to 15 months, depending upon the particular product.

Sheet Steel Output Hampered

Removal of steel allocation restrictions and collapse of Wyatt's prefabricated house program will help ease the steel situation a bit. Nevertheless sheet steel production continues to be hampered by trouble in getting labor for a third 40-hr. shift and by low productivity in operations which workers can control. Two 40-hr. shifts are not enough to give the necessary tonnage, and mills cannot afford to use men overtime at present high rates.

Steel users meanwhile are resorting to various tricks to employ available kinds of steel instead of the kinds they really want. One automobile body maker, for example, has redesigned and reengineered many parts going into its bodies. Roof sheets have been cut up to make strip steel for small parts because of the strip shortage. This is expensive, but keeps up production.

New Machine Tool Orders Off

Uncertainties about future business and postponement or cancellation of tooling programs by customers are taking their toll of new machine tool business. Outlook for 1947, however, is reasonably satisfactory. Machine tool shipments for 1946 are estimated at $315,000,000, compared with $407,315,000 in 1945 and $189,000,000 in 1937, the best prewar year. In making comparisons with 1937, one should make some allowance for price increases in the intervening years.

Delay in shipments of machine tools to foreign customers has grown out of the shortage of lighters in New York harbor and out of the recent maritime strike. Machines are backed up in builders' plants awaiting transportation facilities.

Tool and Die Shops Busy

Contract tool and die shops are fairly busy. About half the work in the Detroit area is on tools, jigs and fixtures for customers outside the automotive industry. One midwest shop is loaded with die orders for a refrigerator maker. Shops generally are running 42-45 hr. Cancellation of some of General Motors' tooling programs will cut into Detroit shop operations.

1947 Output Depends on Labor

Next year's metalworking activities are beclouded by labor trouble. Output will depend upon how many days shops can run. If a series of strikes occurs, like those last winter, the automobile industry, for instance, cannot turn out more than 4,000,000 cars and trucks in '47. If things run more smoothly, production of 5,000,000 units will be possible.

Automobile industry observers report a tendency to exercise caution in planning future operations. Fears of another steel strike in the offing are a compelling factor in tempering future plans with conservatism.

SALES AND INVENTORIES

Data: Dept. of Commerce

Pre-Strike Picture—Before the coal strike cast its damaging pall across industry, inventories were a little out of line with shipments. The important question ahead "will shipments catch inventories as both go up, or will both go down?" Uneven flow of supplies of plentiful materials caused pile-ups while awaiting for scarce key items, such as electrical motors. If stocks fail to balance out, orders for excess goods will be cut

Wyatt, Small Resignations Signal End of Government Controls

WASHINGTON—Resignations from two important government officials —Wilson W. Wyatt as National Housing Expediter, and John D. Small as administrator of the Civilian Production Administration— were accepted this month by President Truman.

Wyatt's resignation signaled adaptation of the housing program to the government's announced policy of relaxing controls. An ardent champion of strong Federal housing controls, Wyatt's abrupt resignation was attributed to clashes with Presidential advisers and other high government officials over policy.

700,000 Units Completed

In reviewing the housing program, Truman said a million dwelling units would have been started and 700,000 completed by Jan. 1, and another 300,000 conversions and temporary units had been undertaken.

The Administration's future housing program, he said, will embody many steps taken to stimulate construction of low-rental housing.

Wyatt's contention that steel and other materials should be assigned to production of pre-fabricated metal houses and that government funds should be available to finance builders drew considerable opposition.

In stepping out of his important CPA post, Small warned of a definite recession if the nation faced a long coal strike. He pointed out factories, closed down because of the strike, will require two to three weeks before they can resume production after a mine settlement.

See Production Delay

"But it will take at least 45 and possibly 60 days to get back to anywhere near normal production," he added. Prompt settlement of the strike and absence of additional labor stoppages would enable the country "to roll on the right track," he stated.

Small predicted most of the agency's control will be abandoned within the next three or four months. He excluded, however, controls over inventories, which he felt should be retained for sometime.

CPA, OPA and other emergency agencies will probably be consolidated into an over-all liquidating agency shortly. Truman has not revealed what step he will take.

FATE OF STEEL SUPPLY STUDY RESTS IN HANDS OF HARRIMAN

WASHINGTON — Secretary of Commerce Harriman will ultimately decide the fate of the Commerce Department's controversial study of the long-term adequacy of the country's steel supply. Steel industry representatives have decided to sit in on the study.

The project involves collecting —industry by industry—projections of the needs of major steel consumers, based on high and low levels of employment. Auto firms had much to do with launching the study. They feared ambitious production plans ahead might be crippled by inability of steel producers to keep them supplied.

Strike Halts Pittsburgh Mills From Clearing Up Books in 1946

PITTSBURGH—Despite pruning in flat-rolled orders, the coal strike will serve to handicap the mills from clearing books by the end of the year. The carryover will complicate the delivery situation during the first quarter. Tentative schedules already set up for the first part of 1947 will likely end up in confusion.

Priority tonnage which may not be shipped also will complicate things. These priorities are set to be continued in the first quarter, according to OPA.

The light flat-rolled situation may not hold true of other finished steel items, but extra consumer pressure for tonnages is certain. This was already evident in bars.

Difficulty in obtaining shapes and plates will delay the freight car building program, particularly.

Operating hardships has caused virtual neglect of steel prices. No major producer has increased quotations but there has been a gradual accumulation of higher extras and other boosts by an assortment of smaller producers in most lines.

Current developments are reportedly bringing the prospect of a general price increase closer, but no action is expected pending the end of labor troubles. This might extend beyond the conferences with the United Steel Workers in January.

Malleable, Gray Iron Foundries In Cleveland Feel Coal Impact

CLEVELAND—Malleable iron foundries in the Cleveland area were one of the first to feel the full impact of the coal strike, many of the plants being forced to close within 10 days after the coal strike while others operated only some departments.

Malleable foundrymen not only found their supply of coal and coke cut off, but faced almost complete absence of pig iron as well. The shortage of these two important items threatened to cause a quick work stoppage where reserve stocks of coal and pig iron were not available.

Scarcity of scrap is another disadvantageous aspect of the foundry situation. Some foundry owners hoped the recent price rise in scrap would start it flowing.

The first 10 days of the miners' strike had little or no effect on the machine tool builders in the Cleveland area. As the strike continued, however, a number of plants began curtailing operations, principally due to shortage of castings and pig iron.

Machine tool builders, prohibited from building an inventory of pig iron during the war, have been unable to lay hands on more than enough since the end of hostilities to keep their plants in operation. As flow of this material lessened, the machine tool industry began limping.

Gray iron foundries in the Cleveland began tapering off operations as shipments of coke and pig iron dwindled. Scrap, while not in plentiful supply, was not the immediate cause of the shut-downs, which started the first week in Dec.

One or two plants operating machine shops in connection with foundry operations, continued shop operations as long as coal was available for heat.

Foundrymen were also concerned about the quality of coke they will receive directly after miners returned to work. Many recall the sad experience of using inferior coke after coal production resumed last spring. Rather than use poor grade coke, some plants considered remaining closed until suitable stocks of coal and pig iron are on hand.

Ohio Arsenal Sells Shells

CLEVELAND—Sale of scrap shells for the four-month period ending Nov. 1 at the Ravenna, O., arsenal totaled slightly more than $1 million, making that arsenal the No. 1 scrap supplier in the nation. Already 169 carloads of scrapped cartridge cases have gone to hungry brass mills and 30 additional carloads were ready for sale early this month.

The scrap, which includes copper and steel as well as brass, comes from old and defective shells which have been returned to the arsenal from Europe. A machine with an 1,800-lb. pulling capacity is used to extract the steel case from the shell.

Hinshaw Attacks Soviet Economy At ASME Confab; Symposiums Held

Charging the engineer with the responsibility of using his vision, combined with his practical knowledge of industry, to bring truth to "those who would chase after the rainbow to the left," Congressman Carl Hinshaw of California keynoted the 67th Annual Meeting of the American Society of Mechanical Engineers, held in New York, Dec. 2-6.

Claiming that the Soviet system is the economy of an enormous prison, Mr. Hinshaw said, "We don't want it in America."

On worker productivity, he said, "The worker must be taught the truth. He must unlearn the false theories of the Thirties and learn that it is greater production per hour that makes abundance at lower cost and his pay check worth more to him and his family."

Sen. Flanders Speaks

At the annual dinner, Senator Ralph E. Flanders (paper read by D. Robert Yarnall) asserted that improvement in material conditions depends on close cooperation of high morals with skillful business, technical and political techniques.

He said his own rule of action would be: "First, to recognize the problem of maintenance of employment as the major internal problem and, second, to judge every measure proposed and coming to a vote in Congress by a single criterion, if it is applicable. I will ask the question —what will be the effect of this proposed law on the maintenance of productive, profitable employment?"

Hoffman Issues Warning

Speaking at the management luncheon, Paul G. Hoffman, Pres., Studebaker Corporation, asserted that failure to establish good labor-management relations has jeopardized our entire reconversion program. He said, "Labor and management must bury the hatchet if our economy is to survive. . . . We must have a new set of ground rules controlling collective bargaining . . . and a change in attitude on the part of both management and labor."

Referring to his worry about inflation, he offered four suggestions to combat the inflationary spiral: Productivity must be increased, both individuals and businesses should defer expenditures, the savings bond program should be encouraged and the Government should economize, defer projects not urgently needed and maintain tax rates to yield revenues greater than expenditures.

At a management symposium, Leon Henderson, former O.P.A. Administrator, warned against retarded production, asserting that gains in real wages can revive only from production efficiency and that one hurdle of the sluggish market into which we are moving is slowed production.

Speaking on pricing policies and social trends, Harold G. Moulton, Pres., Brookings Institution, asserted that living standards can be increased only by reducing prices or increasing wages. The latter, he claimed is uneven in operation and restricted in effect, whereas lower prices benefit the entire population and maintain a better balance of economic life.

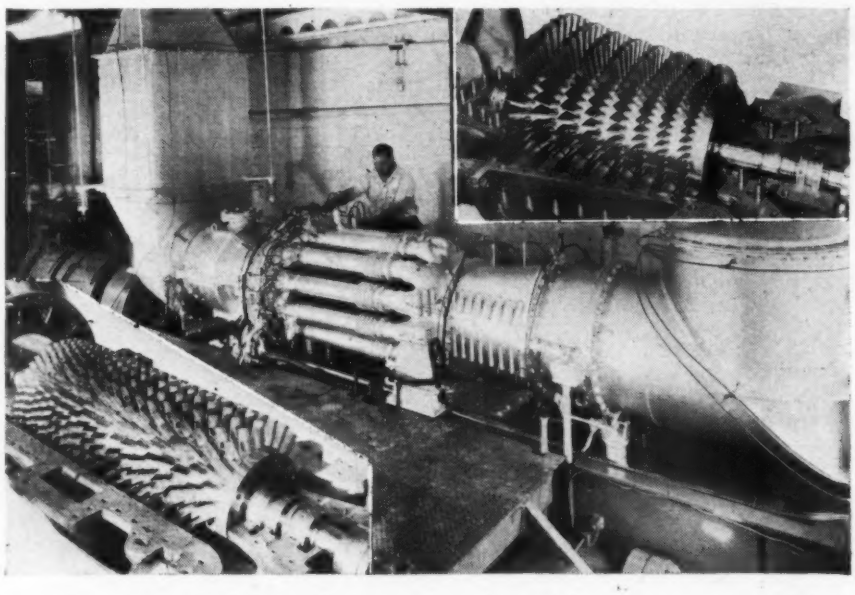
Technical Sessions

Included in the technical sessions were papers on metal cutting, materials handling and plastics. O. W. Boston and W. W. Gilbert reported results on tests to determine tool wear, tool life and power consumption when varying relief angles on carbide milling cutters for cast iron. Normal relief angles of 12° to 15° gave longest tool life and least power for both 0° and 45° pcea tools. At greater angles and higher speeds the cutting edges chipped. George C. Schlesinger discussed simplified measurement of machinability.

Tool Performance Tests

W. H. Wooding, presenting test results on the effect of tool-steel microstructure on tool performance, indicated that variations occur, even with the same heat-treatment. He found that characteristics of the microstructure are associated with red hardness and therefore are of considerable influence in tool performance.

Handling materials through the new Westinghouse plant at Buffalo was discussed by W. D. Ligon, T. C. Fockler and A. E. Goodiven. Final detail plant layouts stressed the importance of their coordination with the design of new line of electric motors. Sidney Reibel described three systems of handling metal chips by conveyor, and P. J. Potter presented an intelligent discussion of materials handling in the foundry.



Prototype Gas Turbine—This experimental 2000-hp. generator set, newly developed by Westinghouse and described for the first time at the ASME meeting, weighs only 19 lb. per hp., occupies only 1/4 cu. ft. per hp. starts in 90 sec. or less. It is an in-line unit patterned after aviation practice, with elements on pivots to permit axial expansion up to several inches.

Components in order from right are: exhaust diffuser, turbine, combustors, compressor, reduction gear and generator. Total length is 26 ft., width 3 1/2 ft., height 6 ft., weight 38,000 lb. Compressor blades (left closeup) are forged from 12% Cr. steel, and caulked into serrated grooves in the forged carbon-steel rotor. 12 combustor cells are carbon steel tubes with chrome-nickel flame tubes. Turbine blades (right closeup) are precision-cast cobalt-chromium-tungsten alloy, tapered and twisted, set in a forged 19-9 stainless rotor 14 1/2 in. in dia. by 24 in. long, largest in this material to date

Detroit Letter

Chevrolet Cancels 1948 Tooling Orders; Affects Other GM Models

The big shop news in Detroit this month was the batch of telegrams dispatched from Chevrolet to a number of die companies working on new body tooling, stopping the entire program. The dies in question were intended for 1948 model output.

This stop order, indefinitely postponing the program and probably throwing it into 1949 model planning, automatically halts the bulk of the 1948 model plans of Pontiac, Oldsmobile, Buick and Cadillac as well. Their forthcoming programs, due to die interchanging, hinged considerably on the Chevrolet plans.

Reasons for Stop Order

Several reasons existed for the stop, although the company had little to say beyond confirming reports which have been current since the beginning of the month. One was that the new designs involved wider bodies and required 96-in. sheets, which are and will be hard to get in quantities.

Another reason involved executive dissatisfaction with some of the design plans. But by far, the largest factor was the unsettled outlook ahead. Stemming from this latter consideration were twin facts—if things clear up and business is good, models will continue to sell even if they are only modestly changed; if they go from bad to worse, the expenditures are unwarranted.

Substantial Layoffs Start

Several of the largest die shops were laying off substantial numbers of men in the wake of the stop orders, and estimates were heard that upwards of $5,000,000 worth of work had been checked off.

Further substantial layoffs were made in design and engineering departments of General Motors, indicating no immediate salvage of the curtailed programs is in prospect.

No indications of consequence emanated from other companies. Ford is understood to have completed the large share of its 1948 model tooling already, so any action it may take would be largely academic. Chrysler was continuing its tooling programs, but there were vague signs in some of the projects that curtailment there may be in the wind.

Future Ford Bodies

From Ford, meanwhile, came some hints of its forward thinking on car bodies. Making his speaking debut as a member of the Ford executive staff, Harold T. Youngren told technical teachers that bodies will widen, glassed areas will increase, and the automobile will become more "a comfortable room-on-wheels instead of just a place where people sit while being carried from one point to another."

As an aside, it might be noted that Youngren and others have drafted former General Motors people into the Ford organization to the extent the drift from Detroit's midtown to Dearborn is becoming a conversation topic. When GM Vice President Frank R. Pierce left GM to join Ford as head of its Dearborn Motor Corp., set up to market tractors, officials in the General Motors building began to greet each other with the laughing query, "Is Ford in your future."

Strike Is Final Blow

The effects of the coal strike were the final, climactic blow to automobile production in a year of dismal inability to reach projected schedules.

This year will have seen production of no more than about 2,050,000 passenger cars and 950,000 trucks, far from the original bright hopes for a 5,000,000-vehicle year in 1946. That historical note is compounded of the effects of the GM strike and others, the lack of materials when strikes were not pressing, and the often desultory worker efficiency in shops.

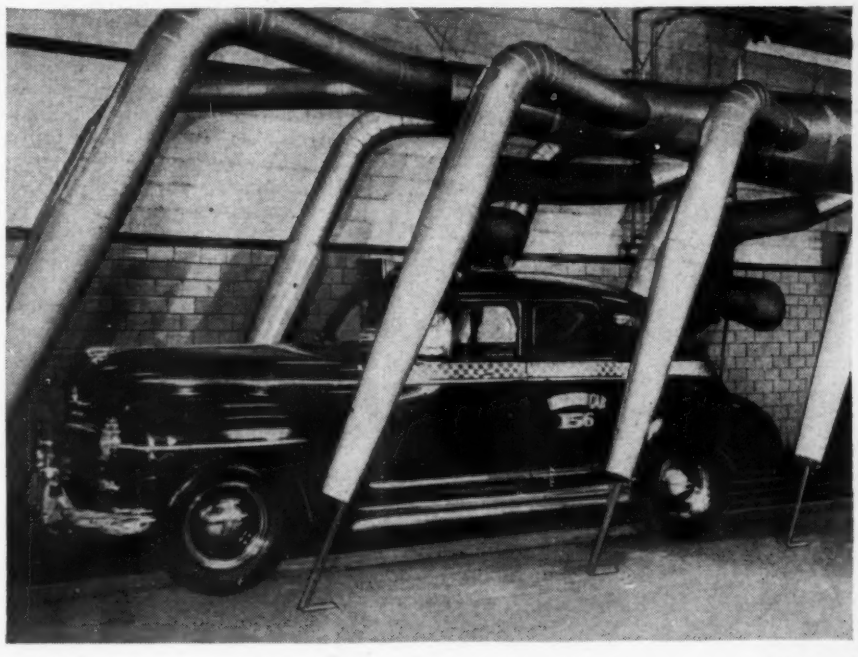
Even Optimists Cautious

What is of more interest is the outlook ahead. None but the simonpure optimists see a calendar year 1947 which will reach above the 5,000,000-vehicle benchmark, even though all industry people expect a good year. But not even the optimists are talking any more in terms of a succession of 6,000,000-car years.

Basic in the forward look is the fact that steel will run short at least through the first 1947 quarter, and probably for the first half. Expanded output notably above the level of 100,000 units per week is therefore all but impossible. And that anticipation does not take into account the possibility of strikes in the major car plants or bottleneck suppliers or fabricators.

Changeovers Late in '47

Following the first half of 1947 will come the need for fairly substantial changeovers to accommodate 1948 model tooling. These will appear fairly late in the year; some suppliers working well into the future have been told to prepare for shipments starting around Nov. 1, which is late indeed.



Auto-Washer—A mechanical automobile washer that can wash, polish and dry a car a minute has been developed by the Minit-Man Auto Wash Co., Detroit. Consisting of two units, a washer and drier, the machine uses production line methods and three operators to perform its task. The washer is a series of continually revolving brushes, on which water is sprayed, bearing against the car, while the drier directs a series of air currents at the car to provide a highly polished appearance

Drastic Strike-Control Legislation Looms As Aftermath of Lewis' Action

WASHINGTON—The new Congress had its job cut out for it by this year's two soft coal strikes.

If there ever was any doubt that strike-control legislation would be enacted by the Republican controlled Senate and House, it was dispelled by the miners' strikes—first against the owners, then against the government operators.

Both Republican and Democratic members of Congress are convinced a way must be found to keep public interest paramount above that of either party to a labor dispute. It has been pointed out that John L. Lewis, United Mine Workers chieftain, gave ample proof that union leaders in basic industries not only have the power to strangle the country but are willing to use it for political purposes.

Proposed Legislative Action

Proposed legislation falls into two groups. One concerns machinery for settling disputes so as to lessen the possibility of strikes. The other involves various proposals designed to bring about a balance of bargaining power between labor and management such as was intended by the Wagner Act. In 11 years, this law has shifted the balance of power to the union side.

As to the first group, there is considerable support for establishment of a Federal mediation board to handle major disputes while the parties cool off for 60 days or so. Organized labor is opposed, and management spokesmen are divided on the question whether such a board should make binding decisions, which amounts to compulsory arbitration, in disputes involving public utilities or affecting the public interest. Labor courts would take considerable time to organize and are not being seriously considered for the future.

Drastic Changes Discussed

Regarding balance of bargaining power, most attention has been directed to changes in the National Labor Relations (Wagner) Act. These proposals would ban the closed shop, place equal responsibilities on labor, accord employers more freedom of speech, permit employers to petition for elections, remove foremen from protection of the Act, and grant employers greater leeway in dealing with strike situations so as to make striking more risky.

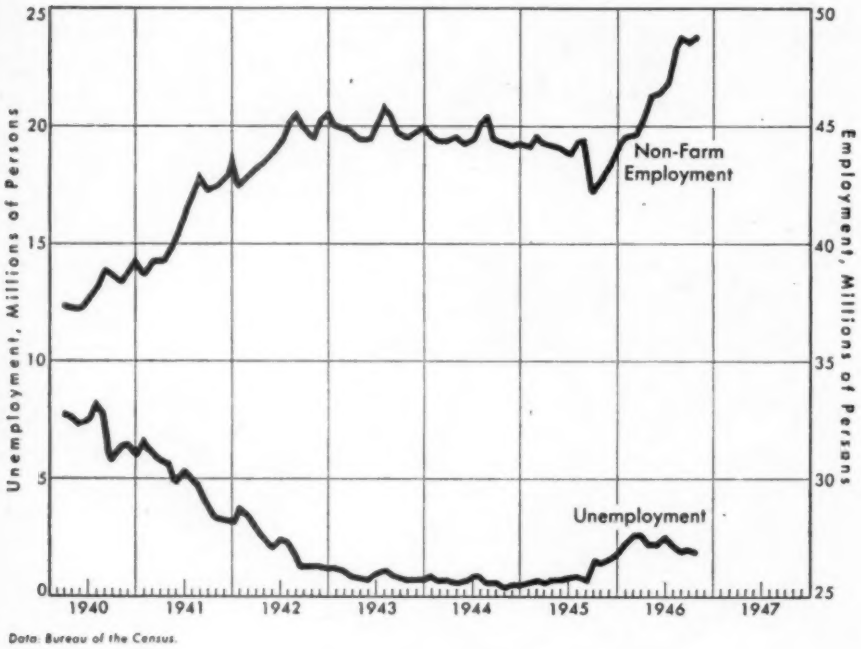
Other measures under consideration in this group are intended to cope with industry-wide disputes, breach of contracts, secondary boycotts and picket-line violence.

Union monopolies and industry-wide bargaining in basic industries, such as we have in coal and steel, for example, is considered the most serious problem because of the paralyzing effect strikes in these industries have on our entire economy. Admittedly, it will be the hardest to deal with.

Ball Proposes Legislation

Sen. Joseph H. Ball of Minnesota, most outspoken of the Republicans on labor legislation, has mentioned the possibility of (1) making arbitration compulsory in industry disputes; (2) bringing unions within the Anti-Trust Laws; or (3) discouraging industry-wide bargaining by imposing drastic regulations.

Ball also thinks employers should be barred from contributing to union welfare funds unless they are jointly administered under a trusteeship which would protect the rights of the individual worker irrespective of his relations with the union.



Data: Bureau of the Census.

EMPLOYMENT HEIGHTS BEFORE THE STRIKE

All-Time Employment Peak—With employee layoffs coming in wholesale lots directly after the miners' walkout, the heights of employment tumbled from all-time highs. Since the reconversion low point in October, 1945, employment scaled upward to almost 49 million. Before the strike, unemployment had fallen off to the irreducible minimum of 2 million idle

HEALTH MEASURES FOR LABOR

WASHINGTON — Labor commissioners and union representatives will seek improvement of state labor legislation to bring in line with standards set by the International Labor Organization. At a national conference the early part of this month, Secretary of Labor Schwellenbach reviewed the need for re-examination of state labor statutes.

Assistant Secretary David A. Morse said state legislation is needed for: night work of children under 18; medical exams for young persons when they enter employment; one-day-of-rest-in-seven; the eight-hour day and 48-hour week, and workmen's compensation. He said only 50% of employed workers in the U. S. are covered by workmen's compensation laws.

Disabled Vets Hired

WASHINGTON — Local USES employment offices placed 19,000 disabled veterans in October, setting a new monthly record. Massachusetts led in percentage increase with a rise of 183% over September placements. Texas, with 1,600 disabled veteran placements, was high in total number of placements during the month. Only 6 states failed to participate in the placement increase.

Washington Bulletin

Industry-minded Ambassador

Further integration of British and American industry, commerce and defense are predicted with the appointment of O. Max Gardner as ambassador to the Court of St. James. Gardner, former governor of North Carolina, lawyer, expert on the devious origins of Washington policy, is also an alert industrialist. He is in textile manufacturing, and an enthusiastic director of the Sperry Corporation, which for years has carried on one of the country's most aggressive technological development programs, mainly for Navy and the Air Forces.

As a conservative Democrat and capitalist, Gardner fairly represents current American viewpoint, which he will carry into socialist England. He succeeds W. Averell Harriman, recently appointed Secretary of Commerce. Gardner was Undersecretary of the Treasury, where he leaves a gap in the administration of Secretary John Snyder, a political appointee from Missouri.

Imported German Scientists

Soon you can hire a German, or even a Nazi scientist. Army will progressively release to industry many of its 1,000 Teuton brain men imported to show us how they put the Reich ahead in rockets and other war gear. Army claims its employment of the German technologists, who brought with them a half million documents and 5,000 tons of research equipment, will save the U. S. nearly a billion dollars on rocket development alone. Release of the German know-how import story is further confirmation that the United States was not even abreast of the obsolete V-2 rocket. The story should have said, further, that the Russians probably got enough German experts to do at least as much as our batch will do.

Surplus Machine Tools

Regional reports on sales of machine tools under the new fixed price listing were about due at War Assets Administration in Washington. Officials expressed satisfaction with increased volume of disposition. Main problem is inventory records, which have lapsed while WAA is setting up its new bookkeeping system. At Cleveland, for instance, orders were received for 2,000 units, but only 200 could be delivered. Stocktaking will be completed soon, sources say, at various warehouses, and fixed price sales will boom.

WAA to Hold Line

Spokesmen for WAA's metalworking equipment division said they believed industry opposition to their fixed-price sales program was cooling down, as they had heard little more of it. They are determined to go ahead with it according to plan, and say they have no further price cutting in mind. According to these sources, some members of the industry committee, after formally opposing the cut, came to them privately and asked that some machinery still under the Clayton formula be moved over to the fixed-price bargain counter, so as to remove it from competition as soon as possible.

Fixed-Price Offering

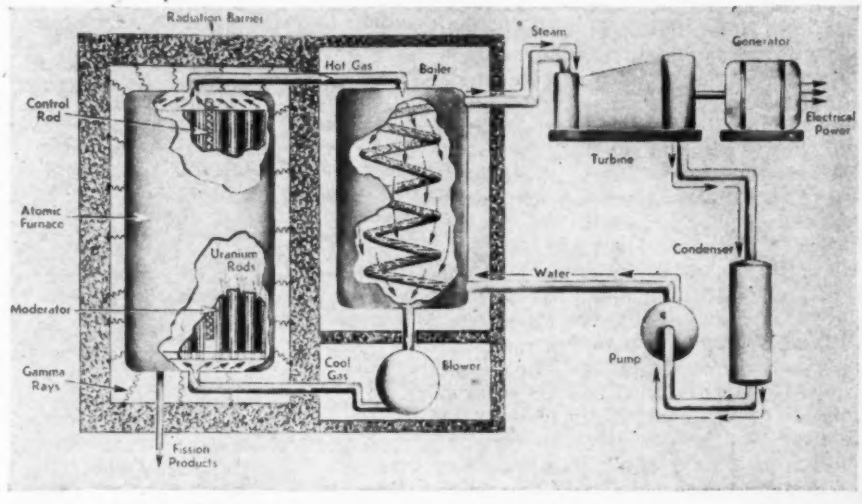
Entire available inventory of surplus unused portable power-driven metalworking machines and tools have been offered for sale by WAA on a fixed-price basis. The $16,000,000 stock consists of pneumatic and electric tools of standard voltage and cycle. They are being sold at established prices, "as is," including attachments and accessories. Used pneumatic and electric tools, and unused electric tools of non-standard voltage and cycle are offered under competitive bid, in lots compatible with commercial practice. Fixed-price offerings of tools are available simultaneously to priority holders and to the general public, first come first served.

Atomic Power Report

Assumption that atomic power will be applied through conventional heat engines, mostly steam, is confirmed in a progress report from Manhattan Project. "As matters stand," says Maj. Gen. L. B. Groves, project chief, "no element of a power plant can be omitted when nuclear energy is used to replace the present forms of fuel, although fuel-handling equipment will be greatly reduced in size and may be omitted entirely in plants designed to operate for a limited time." In other words, nuclear energy will be merely another source of heat. Shortage of equipment and other problems will put completion of pilot plant at Oak Ridge in 1947 or early 1948.

Gradual Price Rise

Prices of cutting tools, machine tool attachments, industrial heat-treating furnaces, industrial scales, material handling equipment, scientific instruments, and air compressors have advanced 2 to 4% in the August-October period, according to Bureau of Labor Statistics, Labor Department. Prices of general and auxiliary machinery and equipment advanced 4%. October prices averaged 17.5% above August 1939 levels; most of the increase since January 1946. Lubricating equipment alone shows a decrease; 1%. Largest price increases are in heat exchangers and water and air coolers; mechanical stokers, power type; industrial oil burners; mechanical power transmission equipment; power driven pumps, fans, blowers.



Atomic Power Plant—Conversion of atomic energy into commercially usable power is shown in principle by the sketch. Gas will be heated through atomic reaction in chamber at left, then pass into center chamber and contact tubes carrying water. Steam thus generated would be conducted to a steam turbine which would in turn operate an electric generator

NAM Adopts Liberalized Program On Labor and Fiscal Proposals

NEW YORK—Putting Public interest ahead of the special interests of business and labor, the National Association of Manufacturers adopted, a new liberalized program on Federal labor and fiscal policy at its meeting here.

NAM recommends legislation to promote industrial peace and good labor-management relations, minimize strikes, and curb labor leader and union abuses without removing the rights of labor to organize and bargain collectively.

The fiscal policy urges a 20% cut in individual income taxes, and relief from taxes for business and industry.

Four-Point Program

American employers were urged to encourage:

(a) High wages based on high productivity, with incentives to encourage superior performance and output;

(b) Working conditions that safeguard the health, dignity and self-respect of the individual employee;

(c) Employment that is stabilized to as great a degree as possible, through intelligent direction of all the factors that are under management's control;

(d) A spirit of cooperation between employees and the management, through explanation to employees of the policies, problems and prospects of the company.

NAM took a position alongside the American Federation of Labor by opposing compulsory arbitration as "inconsistent with American Ideals" and destructive of genuine collective bargaining.

In addressing the sessions, Sen. Joseph H. Ball (R. Minn.) and Sen. Harry F. Byrd (D. Va.) agreed the new Congress will adopt labor legislation to overcome abuses of which the public and business are complaining. Both favored outlawing the closed shop and revision of the Wagner Act. Both criticized John L. Lewis for defying the sovereignty of the U. S. Government and provoking the present labor crisis.

Many of the session speakers stressed the importance of cooperation between management and labor in striving for high levels of production. They cited output of products to meet unprecedented consumer demands as the real solution to economic ills.

Machine Tool Industry Outlook Optimistic, Gaylord Tells NAM

NEW YORK—The machine tool industry is in a good position with a reasonable backlog of unfilled orders and a great opportunity in the offing, said Robert M. Gaylord, president Ingersoll Milling Machine Co. and chairman, NAM executive committee, at the NAM annual meeting. Current production is about 40% greater than before the war, but labor rates are up 70% above prewar and materials have risen 50%. A seller's market no longer exists and many machines can be bought for early delivery.

Both machine tool inquiries and new orders have slowed up appreciably, declared Mr. Gaylord. This danger signal is clearly displayed and concerns every other industry, for it is in the durable goods industries that recessions start. The greatest danger to the machine tool industry is the cyclical nature of the demand for its products. The industry's down cycle results from customers' over-investment in productive facilities and is accentuated because purchase of durable goods can be deferred for considerable periods without serious loss to prospective purchasers.

Depreciation Reserves

Annual depreciation reserves should be spent yearly, believes Mr. Gaylord. This would give more opportunity for higher level of employment, and replacements of equipment would be made when design, delivery and price are unhurried by the rush of boom periods.

Machine tools costing over half a billion dollars lead all commodity surplus offerings during November throughout the country at 850 sales. Commodity classifications include: 1—Industrial, Construction, Mining and Farm Machinery; 2—Motor Vehicles, Tire and Tubes; 3—Automotive Parts, Accessories and Maintenance Equipment; 4—Hardware, other than hand tools; 5—Hand tools; 6—Plumbing, heating and air-conditioning equipment; 7—Electrical equipment; 8—Furniture and office machines; 9—Professional and scientific equipment and supplies; 10—Industrial power equipment; 11—Special industry equipment; 12—Construction materials, paints, military and miscellaneous equipment, n. e. c.; 13—Production supplies; 14—Abrasives, bearings and cutting tools; 15—Machine tools; 16—Metal cutting and forming equipment, except machine tools; 17—Iron and steel; 18—Nonferrous metals; 19—Valves and fittings.

SURPLUS SALES OFFERINGS

(Thousands

Region	Total All Commoditie	1	2	3	4	5	6	7	8	9
Total	1,173,520	63,930	43,260	17,852	40,249	9,769	9,278	24,419	14,748	4,192
Atlanta	12,051	83	—	70	877	899	19	494	226	177
Birmingham	19,828	122	1,551	—	260	89	132	880	46	—
Boston	59,865	324	—	—	1,651	700	4,861	778	15	—
Charlotte	11,256	169	—	90	972	4	340	720	530	—
Chicago	73,540	181	2,734	301	—	20	—	—	466	—
Cincinnati	146,811	2,044	1,163	50	1,165	661	182	467	427	516
Cleveland	59,917	—	1,854	6,611	7,166	199	23	197	4	—
Dallas	30,478	5,347	5,500	1,332	—	75	65	2,500	5,600	—
Denver	4,082	82	2,167	—	—	—	—	—	—	773
Detroit	271,855	—	—	—	—	—	—	—	—	—
Fort Worth	7,173	163	500	—	2,182	—	—	—	—	—
Houston	7,174	—	—	—	—	—	—	—	—	—
Jacksonville	3,628	—	496	—	343	8	15	53	273	—
Kansas City	6,839	132	984	115	63	—	108	—	369	—
Little Rock	2,849	1	422	20	45	10	42	7	404	30
Los Angeles	47,533	3,213	4,278	227	4,188	1,341	1,127	1,708	2,503	113
Louisville	4,181	—	—	—	1,320	297	46	—	22	—
Minneapolis	11,945	—	—	—	—	—	—	—	—	—
Nashville	8,831	70	361	—	2,828	—	—	—	12	—
New Orleans	5,369	159	—	—	73	745	35	29	38	93
New York	104,838	1,697	64	125	6,793	1,465	572	3,526	1,039	1,383
Omaha	4,293	—	2,954	641	—	—	—	—	75	—
Philadelphia	86,617	33,860	3,368	241	304	462	—	7,116	1	—
Portland	1,927	—	—	—	—	—	—	—	—	—
Richmond	14,746	426	782	3	703	1	253	1,131	1,447	624
St. Louis	6,485	118	13	102	430	500	20	216	1	4
Salt Lake City	40,047	8,634	1,557	125	5,869	1,476	857	1,593	139	394
San Antonio	23,378	—	222	—	75	10	69	13	224	—
San Francisco	56,139	1,872	7,882	7,250	1,109	152	278	1,833	245	—
Seattle	22,317	143	4,350	353	1,016	—	—	—	514	—
Spokane	12,668	5,090	7	—	601	28	155	902	66	—
Tulsa	4,860	—	51	196	216	627	79	256	62	85

Strike's Impact on Steel Mills Spragged Efforts to Meet Demand

NEW YORK—Over-all effects of the bituminous coal strike reach into every crevice of industry. Its crippling effect on the steel industry alone stands out in bold relief.

The miners had no sooner laid down their shovels and picks than reports came from steel centers throughout the country that operations were grinding to a close. The second coal strike in 1946 represented another major sprag in the industry's efforts to meet unprecedented demands.

During one week alone in early phases of the coal strike, enough steel was lost to industry to produce 3,550,000 household refrigerators, or 200,000 automobiles, according to American Iron and Steel Institute estimates. The loss in that week of 504,000 tons of ingot represents a 350,000-ton drop in furture finished steel shipments to consumers.

Pittsburgh Output Slashed

Steel mills in the Pittsburgh area endeavored to maintain some semblance of ingot operations and succeeded in retaining a high degree of finished steel output through most of last month.

Steel output, which lapsed from a five-month run of practical capacity to about half-production as a result of the first two weeks of the coal strike, continued its decline. In view of the freight embargo, steel officials surveyed struck facilities for movement of steel and sought to inaugurate storage accommodations for other finished products which could be turned out during the coal tie-up.

Pittsburgh steel officials determined to hold tin plate and sheets at the highest degree of production possible. Steel companies have limited storage capacity for tin plate, but return of miners to the pits saved the situation.

Cleveland Operations Down

Steel-making operations in the Cleveland area started to grind to a halt soon after start of the miners' strike, with Republic Steel immediately reducing operations to 85% with more reductions scheduled.

Sharon Steel cut back to 60% of operating capacity; Thomas Steel curtailed operations by 20% on Dec. 3. Lack of coal caused the National Tube Co. to bank two of its blast furnaces Dec. 2 and the company's coke ovens, which use about 4,200 tons of coal daily and upon whose operations many other departments of this world's largest pipe mill depends for coal-gas fuel, had only sufficient coal to operate only a short time.

In the Mahoning Valley area, only 35 of 83 open hearth furnaces were still operating Dec. 3, and but nine of the area's 26 blast furnaces were still turning out iron.

Chicago Production Gains Curbed

CHICAGO—The first two weeks of the coal strike did not affect Chicago industry, except for the steel mills, too seriously, but manufacturers were getting ready for sharp curtailment as the strike reached its abrupt end.

Metalworking firms began cutting work weeks. Crane Co., for example, cut down from a five to a four-day week in production of cast iron and malleable iron fittings and valves.

Many Schools Neglect to Obtain Surplus Machine Tools from WAA

WASHINGTON—War Assets Administration reports it is turning over large quantities of surplus machine tools and other items to colleges and schools embraced in the GI Bill of Rights. Many schools interested in obtaining surplus equipment, however, have failed to exercise their privilege.

After various interpretations of the Surplus Property Act, OWMR Chief John Steelman stepped in, and Civilian Production Administration gave War Assets a potent directive, enabling it to sell certain machines and equipment at 5% of cost, and ahead of all priorities, to schools in the GI program.

Distribution Impeded

Distribution of surplus to schools has been impeded by a patchwork six-point program evolved by Congress, which nobody understands but which WAA is trying to simplify. Over-simplified, it would say that GI schools can get surplus at 95% off, or free, ahead of all priorities, while all others buy at 40% off, with a No. 4 or 5 priority. WAA is about to lower the 40% to "all others" and give them better preferences.

Surplus up-to-date text books offer a good example of how schools have failed to take advantage of offerings. Such books are offered free, plus 25c per volume handling cost. Available also to GI schools at discounts up to 98% are unit libraries, optical glass machines, surveying instruments and other important items for training purposes.

—NOVEMBER, BY REGION AND COMMODITY

of dollars)

10	11	12	13	14	15	16	17	18	19	Other	No. of Sales
35,859	36,593	22,247	11,897	7,107	503,071	15,742	20,669	7,081	22,055	263,502	850
6	19	354	89	177	396	36	—	—	—	8,129	26
1,928	1,413	344	4,986	126	825	41	560	186	264	6,075	45
—	2,190	6,770	—	—	32,000	—	1,370	643	—	8,563	72
—	440	79	370	—	28	7	900	44	—	6,563	6
2,742	2,496	2,731	1,446	2,380	2,551	1,194	4,511	854	8,002	40,931	18
2,781	1,375	241	299	1	113,267	—	323	7	4,000	17,842	32
1,361	2,644	83	57	163	29,682	9,444	382	16	30	1	16
150	1,275	—	—	200	2,700	—	575	500	70	4,589	36
—	—	—	—	—	—	—	—	—	—	1,060	12
—	—	—	—	2,500	268,000	—	1,150	—	—	205	4
—	—	—	—	—	—	—	—	—	—	4,328	22
—	100	—	—	—	229	—	110	—	156	6,579	10
—	800	—	—	—	592	—	—	—	193	855	14
211	34	95	—	118	—	—	—	118	—	4,492	22
70	220	367	8	—	—	—	—	104	—	1,099	11
2,923	1,046	3,916	199	34	70	441	424	324	316	19,142	67
—	634	130	—	—	—	—	—	—	—	1,732	1
1,492	2,298	122	—	84	5,781	438	1,025	705	—	—	20
—	956	149	—	—	876	39	144	—	—	3,396	13
284	105	463	3	34	298	10	728	216	556	1,500	13
4,829	6,093	1,067	1,330	683	36,076	2,389	3,771	734	3,244	27,958	25
—	—	—	—	—	305	—	—	—	—	318	7
12,170	4,344	1,874	1,524	200	6,730	901	495	1,367	—	11,660	69
84	66	235	88	—	—	—	—	—	150	1,204	12
30	210	413	5	—	172	—	524	103	582	7,337	23
936	191	367	61	171	1,409	217	—	29	862	838	12
355	877	110	—	—	28	—	—	—	1,262	16,771	9
840	2,662	33	29	1	207	9	18	—	1	18,965	19
960	2,829	940	559	108	—	—	3,002	218	813	26,089	114
1,093	530	451	492	21	527	117	383	730	477	11,120	64
573	601	642	113	6	—	444	272	183	1,071	1,914	32
41	145	271	239	100	322	15	2	—	6	2,147	4

Spotting the Air News

Towing Aspects Advantageous

Stinson's new L-13 Army liaison plane, which can be towed on highway with wings folded, could be adopted to private flying with advantage in view of short hangar space at airports.

Are Helicopters the Answer?

Sikorsky hopes to cut price of S-52 helicopter by half to $15,000. Still, it's a long way down to popular market figure. Discouragement over slow sales of fixed-wing planes is leading some manufacturers to speculate on a change to rotary-wing design. A new attack of helicopter fever will hit the public some day.

Engineers in Demand

Boeing is scouting universities for 400 engineers: mechanical, electrical, heating, ventilating, metallurgical, aeronautical, and others. Boeing estimates the need for 50,000 engineers in industry will not be met before 1950.

Air Show Notes

The National Aircraft Show at Cleveland was a magnificient public spectacle but did not measure up to hopes as a stimulator of civil and military aviation. It was good enough to warrant another one, on West Coast, next Fall. The industry and all its allied arts and sciences were elaborately displayed; good thing for all metalworking men to see. The days of tube and fabric light planes is over. Nearly every producer at Cleveland show exhibited an all-metal model. Some still have fabric-skinned wings, soon to be replaced by thin sheet.

Basic Engine Design

For years aircraft builders, hampered by the high cost of engines, have speculated on common basic engine design for both planes and automobiles, at greatly reduced prices. British Nuffield Organization, huge motor car producer, proposes to build a 100 hp. airplane engine for $430. Lord Nuffield has confounded skeptics all his life, and might do it this time.

Wingster Supersonic Flight

A new fiberglas airplane wing has withstood 105% of Wright Field's strength requirements. It is fitted to a fiberglass fuselage which has exceeded strength-weight requirements by 40%. Material is lamination of glass cloth, by Owens Corning Glass Co., and resin by Libby-Owens-Ford Glass Co. Wing interior is free of ribs and bracing, skin has no rivets, joints, protuberances. Very interesting for supersonic flight—and for non-aircraft purposes.

Airplane Speed of Future

It will take about three years to produce airplane speed faster than sound, and 2,000 mph. will be an economical speed from coast-to-coast at a passenger rate of $75, according to Dr. Alexander W. Lippisch, former design chief of the German Messerschmitt Aircraft Co. It means rapid decline of the military engine, air transport and propeller industries, and progressive relegation of the "old" school of aerodynamics.

Coping With Far-Out Airports

The urge to be rid of heavy landing gear, and slow ground transportation to far-out airports, is driving airplane designers toward methods of catapulting and arresting transport planes on platforms, or railroad shuttles. Lewis A. Robert of NACA's Cleveland laboratory, proposes that planes be flown from the landing on high-speed rail cars.

Light Plane Prospects

Light plane industry, a mere peewee with less than 5,000 output per month and prospects of less, is seeking standardization of parts to help cut its high costs. Common use of axles, wheels, brakes, propeller mountings, radio envelopes, and batteries is under consideration by Aircraft Industries Association.

Flying Laboratory—Designed specifically to investigate and study flight and design research problems at transonic and supersonic speeds, the XS-1 was conceived cooperatively by the Army Air Forces, Bell Aircraft Corporation and the National Advisory Committee for Aeronautics. Driven by a powerful rocket engine, the plane is expected to record data at a top speed of 1700 m.p.h. and at an altitude of 80,000 ft., which will lead to the faster and safer plane of tomorrow. The plane, which is said to be the sturdiest ever built, is 31 ft. long, 10 ft. 10 in. from ground to tail tip, with a wing span of only 28 ft., with a range of about 100 mi.

$20,000,000 RFC Plane Might Become Oyster Bar

WASHINGTON—War Assets Administration expects to get Howard Hughes' six-engined wooden flying boat, recently completed at Culver City, Calif., at a cost of $20,000,000, and shipped to water for a sizable sum more.

When Kaiser-Hughes proposed the monster early in the war, Army and Navy turned it down. But Kaiser was in strong with President Roosevelt, who was persuaded big transports could be built of wood, in the absence of steel, to ferry troops and supplies over the submarines.

FDR told Defense Plant Corporation to finance it. So the flying white elephant is owned to the extent of $18,000,000 by RFC, which probably will declare it surplus sometime after test runs. WAA thinks it will end up on some waterfront as a hot-spot oyster bar.

Shipyard Industry Sought India Industrial Development

NEW DELHI, INDIA (McGraw-Hill World News) — A report prepared during 1945 by a group of American technicians for the Indian Government points up some of the hurdles this country must clear in her efforts towards large-scale industrialization. Based on a survey of 57 typical Indian plants—both private and Government-owned — the still unpublished report reveals that India had made a good start toward meeting her own needs in several classes of heavy and light machinery, electrical products, prime movers and basic machine tools.

Hindering better progress, the survey revealed, were: (1) A great shortage of well-trained technical workers with actual factory experience; (2) lack of standardization of production equipment and methods; (3) dearth of concerns manufacturing secondary industrial equipment such as precision gears, reamers, taps and dies; (4) scarcity of reliable statistics on which both productive equipment needs and consumer demands can be estimated; (5) low mass-purchasing power which restricts demands for consumer goods which could be manufactured here under wider industrialization.

The report also made many recommendations for reorientation of industrial policy, some of which already have been followed. These include: (1) establishment of a financial agency like the RFC to aid industrial expansion (Bill awaiting action in assembly); (2) establishment of an organization like the American Standards Association (action underway); (3) Use of government ordnance factories to produce secondary industrial products (not yet, but one has been assigned to road-roller production); (4) securing of proved designs and specifications from foreign firms for manufacture in India by either outright purchase or license agreements.

American Technicians Point Up

VANCOUVER, B. C.—Industrialists hope that the shipbuilding industry will be established in the province on a permanent basis as one of the major industries. During war years, Canada became the second greatest shipbuilding country in the world. British Columbia yards produced more than 70% of all cargo ships built in the Dominion.

When V-J Day arrived, contracts held by B. C. shipyards were in many cases cancelled and it looked as though the shipbuilding industry would fade away. Now it appears the industry will employ several thousand workers for at least two years.

Names in the News

Paul W. Polk

Paul W. Polk has been appointed vice president and manager of the Threadwell Tap & Die Co., Greenfield, Mass., recently acquired subsidiary of the Sheffield Corp., Dayton, Ohio. Mr. Polk has been vice president of the Sheffield Corp. for several years and will continue as an officer and director of the parent firm.

Frank R. Pierce, a former vice president of General Motors Corp., has become president of the Dearborn Motors Corp., the newly formed company which will distribute Ford tractors and farm implements.

Ray H. Morris has resigned as vice president of Hardinge Brothers, Inc., Elmira, N. Y.

Arthur E. Jacobs has been appointed vice president and sales manager of Blackmer Pump Co., Grand Rapids, Mich. Also, **John B. Caldwell** has been named chief engineer.

Gordon B. Evans has been appointed chief engineer and **Robert L. Crinnian** assistant chief engineer of the Pioneer Engineering & Manufacturing Co., Detroit.

Lloyd E. Lee, formerly vice president in charge of sales and engineering for Plan-O-Mill Corp., has resigned to join the machine tool division of Frederick Colman & Sons, Inc., Detroit.

Karl D. Fernstrom has been appointed vice president and director of production by the American Machine & Foundry Co.

J. F. Simon, Jr., has been named works manager of the Paul & Beekman Div., Portable Products Corp., Pittsburgh.

Charles R. Miller, Jr., vice president in charge of purchases of the United States Steel Corp. of Delaware, retired Dec. 1 after 49 years with U. S. Steel subsidiaries. He is succeeded by **Carl A. Ilgenfritz,** formerly vice president in charge of purchases of Carnegie-Illinois Steel Corp.

L. H. Moulton has been appointed sales director and **D. T. Buist,** assistant sales director of Turco Products, Inc., Los Angeles.

J. A. Martino has been elected executive vice president and **C. F. Garesche** a vice president of The National Lead Co.

John C. McPherson, formerly director of engineering has been appointed manager of patent research and development of the International Business Machines Corp., Endicott, N. Y.

Robert T. Dunlap has resigned as executive vice president of Colorado Fuel & Iron Corp., Buffalo, N. Y. to become president of Great American Industries, New York City.

Robert O. Bullard has been named engineering and manufacturing manager of the Metallurgy Div., General Electric Co., and **Edgar L. Hubbard** has become divisional sales manager.

Nelson F. Bowe, district manager since June 1944 of the Long Beach, Calif. district of Ford Motor Co., has been promoted to district manager of the Edgewater, N. J. district sales office.

Dr. C. Earl Webb has been appointed chief engineer of the American Bridge Co., to succeed **Dr. Charles F. Goodrich,** who is retiring after 40 years with the company.

Lincoln Electric Co. has appointed seven new welding sales engineers. Included in the group are: **Marvin Anderson** in Moline, Ill., **Albert Bavaria** at Philadelphia, **Richard Freundlich** for Cleveland, **Paul Holden** in Franklin, Pa., **Richard Nelson** and **John E. Williams** in Syracuse, N. Y. and **Richard K. Reynolds** in the Detroit office.

Joseph Miesch has been named president of the New England Etching & Plating Co., Holyoke, Mass., while **Emile L. Willemain** has become vice president and general manager.

Gilbert V. Horohoe has been named director of quality control for the Twin Coach Company's Buffalo, N. Y. and Kent, Ohio plants.

R. B. Tripp has been named executive vice president and **T. E. Leighton** has become vice president and treasurer of the Ohio Forge & Machine Corp., Cleveland.

BUSINESS ITEMS

Robert Walsh

American Car and Foundry Co. has established an **Automotive and Export Department** at its Wilmington, Del. plant which is being headed by **Robert Walsh.** The department will specialize in the building of self-propelled cars for single and multiple operation, for both the foreign and domestic fields.

Joseph T. Ryerson & Son, Inc., Chicago, has recently moved into a new office building at its Pittsburgh plant, Arch St. and Bell Ave.

Fischer & Porter Co., Hatboro, Pa., is changing the name of its flow rate instruments from Rotameters to Flowrators.

Progressive Welder Co., Detroit, has formed a **Process Engineering Department** to assist industry in forming plans on the use of resistance welding equipment. The department is headed by **Ray A. Obrecht.**

The Kelly Reamer Co., Cleveland, has appointed the **O. A. Muenz Co.** as its exclusive sales and engineering representative in lower N. Y., northern N. J. and Fairfield County, Conn. The Muenz company offices are located at 239 Bloomfield Ave., Bloomfield, N. J. and 932 E. Main St., Bridgeport, Conn.

MacKenzie Machinery Co. has moved to new and larger quarters at 172 Second St., Cambridge, Mass.

St. Paul Hydraulic Hoist Co., Minneapolis, Minn., a subsidiary of **Gar Wood Industries, Inc.,** Detroit, has become an operating division of Gar Wood and is now known as the **St. Paul Hydraulic Hoist Div. of Gar Wood Industries, Inc.**

The McDonough Foundry and Machine Co., McDonough, Ga., has been organized by **John L. Sinback.** In addition to Mr. Sinback, officers include **T. A. Asbury** and **J. Greer.**

The Carborundum Co., Niagara Falls, N. Y. has moved its New York district sales office and warehouse to 34 Exchange Pl., Jersey City, N. J.

Acme Aluminum Alloys Inc., Dayton, Ohio, has opened a branch office in the Commercial Trust Bldg., Philadelphia, Pa.

Reed-Prentice Corp., Worcester, Mass., has moved its west coast sales and service facilities to 2838 So. Santa Fe Ave., Los Angeles, Calif.

Allegheny Ludlum Steel Corp. has opened a new warehouse at 1270 McCook Ave., Dayton, Ohio, where it will stock tool steels for southwestern Ohio and Ky. **R. J. Swan,** district sales manager, will supervise warehouse operations.

The Olofsson Tool & Die Co., Lansing, Mich., has completed a new plant at 2727 Lyons Ave., which will consolidate the operations of the firms two former plants.

Otto E. Zahn has resigned his position with **American Wheelabrator & Equipment Corp.,** Mishawaka, Ind., to establish his own consulting service. Specializing in problems in patent research and development, product engineering, industrial engineering, metallurgical research and chemical and electrical engineering, his office will be located at 218 Napoleon Blvd., South Bend, Ind.

The Tomkins-Johnson Co., Jackson, Mich., manufacturers of air and hydraulic cylinders, die sinking milling cutters, air controls, etc., have appointed **C. E. Hamilton,** 1411 4th Ave. Bldg., Seattle, Wash., and **A. B. Andrews, Jr.,** Insurance Bldg., Raleigh, N. C., as its representatives.

The Cleveland Tapping Machine Co. has appointed the **Burgan Machinery Co.,** 9527 Fifth Ave., Inglewood, Calif., as its sales representative in Calif., Nev. and Ariz.

Balcrank, Inc., Cincinnati, has formed an automotive parts division for the manufacture of and sale of automotive replacement parts under the management of **Robert E. McGill,** former sales manager of Aluminum Industries, Inc.

Spencer-Harris Machine & Tool Co. has been formed as a machine shop in Gladewater, Texas by **E. F.** and **Lee Spencer** and **Wayne C. Watson.**

Rheem Manufacturing Co. is closing its Salt Lake City's manufacturing division and moving it to Chicago. No change will be made in the sales and service departments in Salt Lake City.

International Harvester Co. has purchased the **Moore Equipment Co.,** Stockton, Calif., producer of specialized farm machinery.

Niagara Aluminum Casting Co., Inc., has been incorporated in Buffalo, N. Y. by **Leroy H. Hurlbert, Bessie K. Delaney** and **William G. Conable.**

OBITUARIES

Edward G. Budd

Edward G. Budd, 75, founder and president of the Budd Co., passed away Nov. 30. Mr. Budd established the Edward G. Budd Manufacturing Co. in 1912 and the Budd Wheel Co. in 1916. The two firms were merged last June into the Budd Co. He first started his business by dedeveloping the all-steel automobile body. In the early 1930s the company set up a division for the manufacture of stainless steel products and became noted for its stainless steel trains.

William Werme, 65, general superintendent of the Worcester Pressed Steel Co., Worcester, Mass. passed away Nov. 30. He has been a director of the firm since 1910. Before joining the company in 1905, he was associated with the Reed-Prentice Corp. and Heald Machine Co.

John J. Kane, 63, general patent attorney for the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died Nov. 8.

Clinton E. Swank, 57, first vice-president of Dayton Malleable Iron Co., passed away Nov. 26.

William C. Johnson, 58, founder of the Morlock Machine Co., Danbury, Conn., died Nov. 16.

Norman M. Shrigley, 47, operator of the former Equipment Manufacturing Co., Buffalo, N. Y., died Nov. 16.

MEETINGS

American Society for Testing Materials. Spring meeting and committee week. Benjamin Franklin Hotel, Philadelphia, Pa. Feb. 24-28. R. J. Painter, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

National Materials Handling Exposition. Public Auditorium. Cleveland, Ohio. Jan. 14-17. Ezra W. Clark, chairman, P. O. Box 178, Battle Creek, Mich.

Society of Automotive Engineers. Annual meeting and engineering display. Book-Cadillac Hotel, Detroit, Mich. Jan. 6-10. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

THE LABOR CRISIS

..."Absolute power corrupts absolutely"

THE NEW CONGRESS is going to overhaul the federal laws governing organized labor. If the election returns left any doubt about that, John L. Lewis has removed it by torturing the nation with its second soft coal strike in six months.

If, however, the overhauling is to get at the roots of our labor troubles, it must go further and deeper than most of the proposals would go. Indeed, it must not stop until it has dealt decisively with that most basic cause of devastating trouble – the entrenched monopolistic power of enormous international unions, now concentrated in a handful of union leaders. Industry-wide collective bargaining is one outgrowth of this power.

"Power tends to corrupt, and absolute power corrupts absolutely." That great truth, phrased by the historian Acton, is as true of labor leaders as it is of business leaders, princes or potentates. It is also true that John L. Lewis and some of his fellow labor leaders now wield what approaches absolute power in their respective domains. Failure to recognize these facts and act on them can make a tragic mockery of the present opportunity to restore good sense and good order to our labor relations and our national life.

To realize this opportunity the labor monopoly must be made a major target.

In the minds of many people, particularly in the business community, the root cause of our labor troubles is to be found in the National Labor Relations Act, commonly called the Wagner Act. They feel that if they could get rid of the one-sided handling of a number of key labor problems provided by that act and its administrators, we would have the legislative part of the problem of creating good labor relations pretty well solved.

To be sure, there is occasion, long overdue, to balance up the lopsided treatment of labor relations by the Wagner Act and those who apply it. It has been so interpreted and applied as to deny free speech to employers. On occasion it has extended the special protection of the federal government to workers striking to force employers to break the law. It has done the same for workers striking to force the federal government to change its policy the way the strikers want it changed.

The Wagner Act has required employers to bargain with unions, but imposed no companion obligation upon unions to bargain with employers. It has given protection to workers who have broken their agreement by striking. It has been applied so as to break orderly lines of management by encouraging and giving special protection to union organization of foremen who, to do their work efficiently, must represent management. Abuses such as these should be cleaned up, and soon.

Monopoly is the Target

But if perfection were attained in eliminating all of the abuses stemming from the Wagner Act, numerous and grievous as they are, the basic problem of establishing the legislative foundations of sane and safe labor relations in the United States would by no means be solved. John L. Lewis and his fellow labor dictators would, no doubt, be annoyed, but their power would not be seriously impaired. *That power is derived from monopoly control of labor.* Just as in the case with any other kind of monopoly power, it will only be made subservient to the public interest by attacking it at the source and smashing it.

The way to do that is to apply the anti-monopoly laws to monopolies in the field of labor just as they are applied to business and industrial monopolies. At the same time more vitality should be pumped into these laws all along the line.

When our basic anti-monopoly law, the Sherman Antitrust Act, was passed in 1890, it was designed to apply to economic monopolies of all kinds, and was so held by the courts. Organized labor sought exemption from this law, largely on the ground that its bargaining power was weak, as compared with that of industrial corporations. In recent decisions, a majority of the United States Supreme Court

justices have held that, when combined with the Clayton Act of 1914, the Norris-La Guardia Act of 1932 gives organized labor virtually complete exemption from the antitrust laws.

In the meantime, the relative weakness in bargaining power which was made the occasion for exempting organized labor from the antitrust laws has become a myth. In soft coal, John L. Lewis is the monopolist. Through his United Mine Workers he controls about 90% of the miners. No one of the thousand or more highly competitive companies engaged in soft coal mining controls more than about 5% of the output.

In steel the monopoly control is that of Philip Murray's United Steel Workers whose organization represents well over 80% of the production workers in that industry. United States Steel, the corporate "giant," controls only about one-third of the steel making capacity. In automobiles the United Automobile Workers represent about 90% of the production workers. A year ago the union's officers flaunted their monopoly power by announcing plans to pick off one automobile manufacturer after another by a series of centrally controlled strikes.

Industry-Wide Bargaining

Confronted by the rise of government-fostered monopoly power in the hands of organized labor, employers in some industries have sought to match it by joining together for collective bargaining on a more or less industry-wide basis. In other industries, notably steel, the federal government, through the War Labor Board, took the lead in forcing a pattern of industry-wide bargaining. Bedevilled by a myriad of cases, the Board thus sought to settle scores of them in the steel industry by one action.

It is easy to understand how an employer, confronted by an industry-wide monopoly of labor, would be tempted to join with his fellow employers in an industry-wide bargaining group. In that way he might see a chance to establish something like equality in bargaining power.

However, if the employers' bargaining group were as effective as the union in creating a monopoly set-up, it would merely confront one monopoly with another. That, in turn, would heighten the chances of having either a devastating head-on collision as a result of failure to agree, or having the two monopolies reach an agreement at the expense of the consuming public.

Actually, however, the chances that employers can create an industry-wide bargaining group as tight as that created on the side of labor by union organization are virtually zero. For if a group of employers were to agree to shut down in unison or take other united steps to balance the bargaining power created by the threat of a monopolistic union to strike, they would unquestionably find themselves on the receiving end of an indictment for violation of the federal antitrust laws.

To Break the Monopoly

Thus, both from the point of view of the public and the point of view of the employer, industry-wide bargaining is no effective offset to the monopoly power created by industry-wide unions.

The only way to cope with this monopoly power is to subject it to the anti-monopoly laws in the same way business and industrial management are subjected. In the process industry-wide labor monopolies would be cut down to safe size, possibly by limiting the percentage of workers in any industry who are permitted to belong to a single labor organization.

Also application of anti-monopoly laws would clean out local pockets of labor monopoly which block the way of industrial progress. As matters stand, the freedom of unions from control by the antitrust laws permits organized workers in one city to refuse to install equipment shipped in from another city, thus establishing private tariff walls. It also permits organized workers to refuse to install or work on materials made by other workers whose union affiliation, or lack of it, they do not like.

If the anti-monopoly laws were applied to organized labor, boycotts of this sort would be outlawed. In the aggregate they now take a tremendous toll for no legitimate purpose. But primarily John L. Lewis and a handful of his fellow labor dictators might be cut down to a size that can be safely accommodated by the American democracy. If that is not done, the last great opportunity to give industrial and political democracy a chance to work, in its last great stronghold, will be lost. From such a tragic turn of events no one would lose more than the American worker.

President McGraw-Hill Publishing Company, Inc.

Shop Equipment News

Gray Horizontal Boring, Drilling and Milling Machine Includes Simplified Control Methods, Non-metallic Ways

A PLANER-TYPE horizontal boring, drilling and milling machine has been introduced by the G. A. Gray Co., Cincinnati, Ohio. The machine includes Gray non-metallic ways for the table and column base, electronic drive for all feeds, and automatic power clamping of the table, column, headstock and end supports.

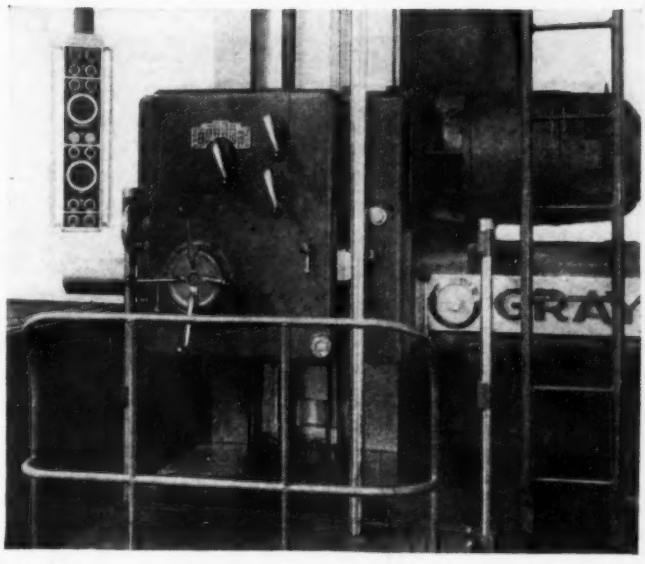
Particular emphasis in designing the machine has been placed on simplifying the control. Controls for the head, column, spindle and table are centralized on the pendant switch which is counterbalanced and carried on a universal support, so it can be placed in any convenient position. A selector on the pendant switch can be set to one of three positions, depending on whether the column, headstock or spindle is to be operated. A single motor controls speed and rapid traverse for these units. Four pushbuttons and a potentiometer are used to obtain feed, rapid traverse and micro positioning of the unit for which the selector is set.

A separate motor is used for feed and rapid traverse of the table. A selector switch can be used to clamp or release the table. Three pushbuttons control the motor for driving the boring bar.

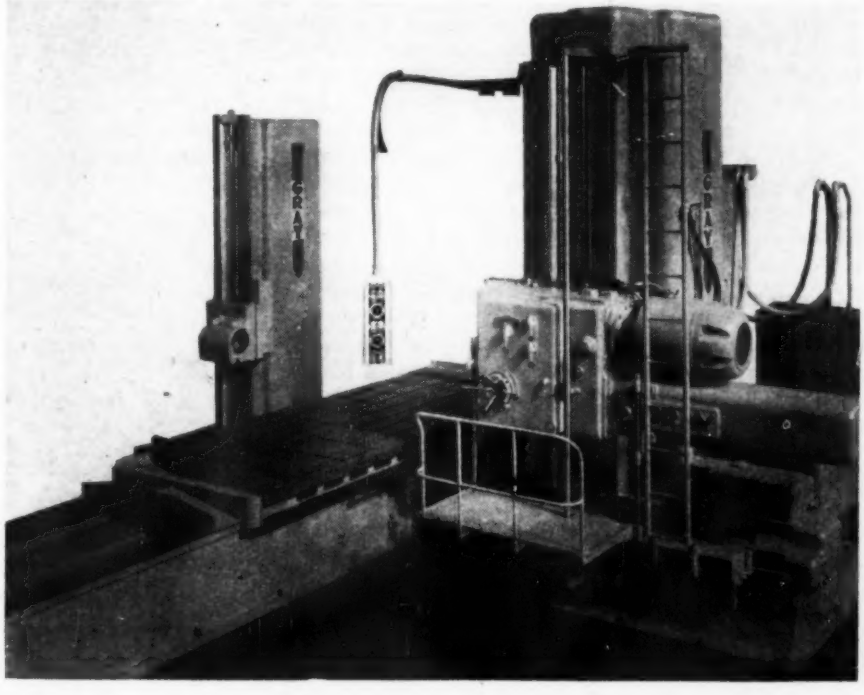
The "Gray Woodpecker" positioning device sets the various units within 0.00025 in. by pressing a micro-jog button on the pendant switch. The single heavy-duty spindle is provided with 24 speeds in geometric progression. The normal range for the 5- and 6-in. bar is from 4½ to 900 rpm., and for the 7- and 8-in. bar from 2½ to 500 rpm. Lower speed ranges can be furnished.

Safety devices and interlocks are provided to protect both machine and work. Overload protection for the spindle motor insures stoppage of the feed motors before the spindle motor stops. The feed motor cannot be operated except for jogging and rapid traverse unless the spindle motor is running.

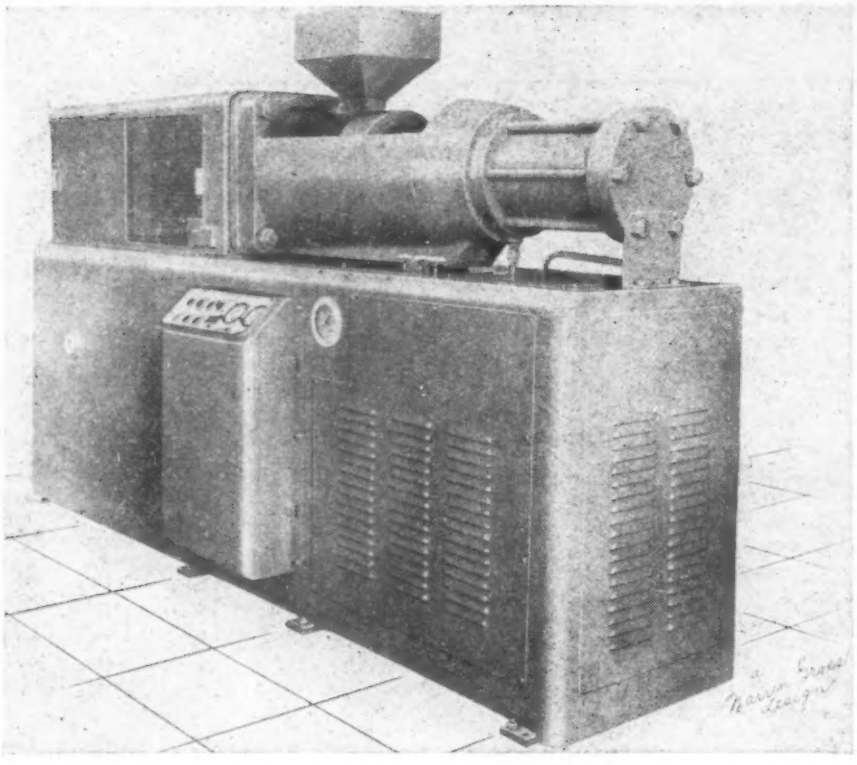
The runway has three flat ways and is wide, deep and heavily ribbed to support the column rigidly. It is provided with closely spaced leveling screws. The middle way forms a long, narrow guide with non-metallic guiding surfaces. A bore aligning device maintains constant contact against one side of the guide to insure smooth, straight-line motion of the column when feeding the column instead of the bar.



Simplicity of control of the planer-type horizontal boring drilling and milling machine is indicated by the detailed view of the head and pendant switch at left. This simplicity gives the operator a feeling of confidence which is said to result in his handling the machine with more speed and accuracy. A general view of the machine, which includes Gray non-metallic ways, is shown below



Hydraulic Machinery Plastic Molder Has Electronic Temperature Control



Hy-Mac plastic-injection molding machine has maximum pressure of the injection plunger of 28,400 psi. when operating at 1,000 psi. line pressure. Machine will not operate when safety gates are open

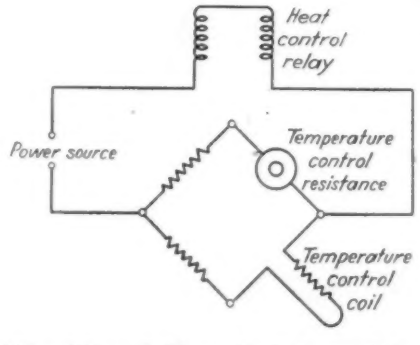
A plastic-injection molding machine of 2-oz. capacity Hy-Mac Model IM-2 is announced by Hydraulic Machinery, Inc., 12825 Ford Road, Dearborn, Mich. The design by Warren Gross is said to have achieved new controllability, ease of operation, and efficiency. The machine is the company's first production under its own name in the plastics field.

Two electronic controls regulate heat in the chamber and nozzle with an accuracy of plus or minus 2 F. The control is so mounted that it is not affected by machine vibration.

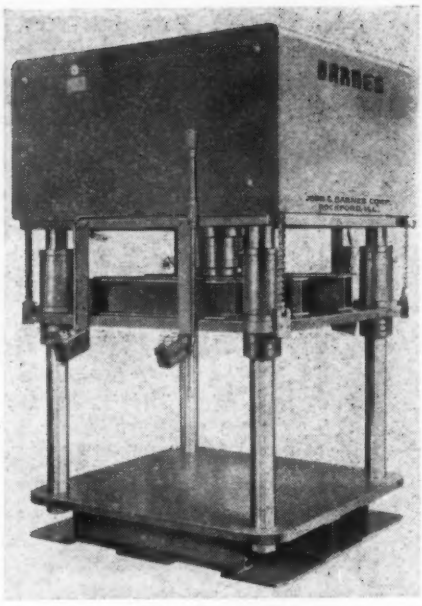
The temperature control coil is a long coil of resistance wire wound on a ceramic cylinder and buried in the nozzle and melting cylinder walls. Because of its length, variations of 1 F. will unbalance the Wheatstone bridge circuit and cause the heat-control relay to operate. Variations from the temperature setting causes this action, not the actual temperature set on the temperature control resistance.

The machine has a 50% overload capacity. It will take up to 6 shots per min. All controls are electrically operated and are located in one electric panel including switch relays, timers, temperature controllers and motor starter.

The injection stroke requires 3 sec. for the full 8-in stroke. Rate of travel is 100 fpm. Clearance between strain bars is 12½ in. both at top and sides. Platens are adjustable to hold dies varying from minimum of 5½ in. to maximum of 9½ in.

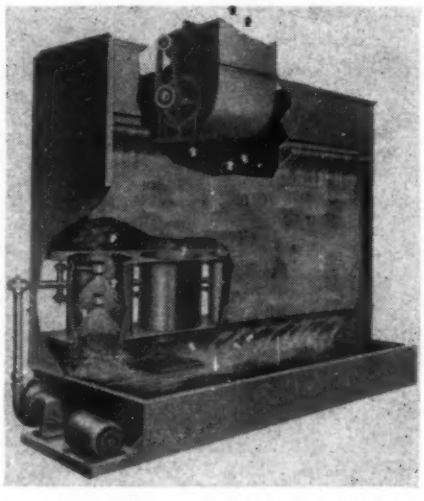


Wheatstone bridge circuit is used to control temperature in the nozzle and melting cylinder



HYDRAULIC PRESSES—Two hydraulic presses of 25-ton (shown above) and 50-ton capacities are announced by John S. Barnes Corp., 301 S. Water St., Rockford, Ill. The presses are designed for piercing, punching, forming, and drawing of sheet-metal parts. Each press is powered by a self-contained hydraulic unit for smooth operation and finger-tip control

Newcomb-Detroit Spray Booth Has Water Curtain and Tubes

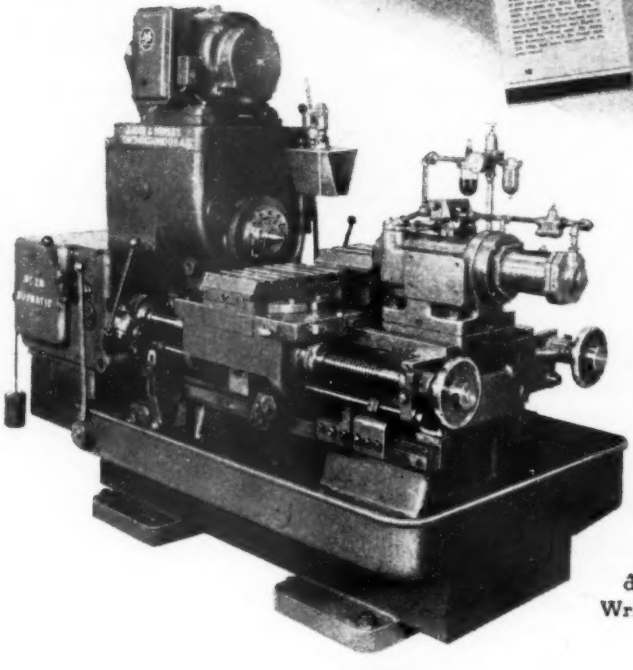


A water-tube spray booth which is shipped 90% assembled, is announced by Newcomb-Detroit Co., 5741 Russell St., Detroit 11, Mich. The booth is a water-curtain type with a series of tubes, each of which contain two high-velocity, clog-proof nozzles to wash the air. The air is then drawn by suction through moisture separators and discharged.

The discharge fan, water-recirculating pump and motor are built in the unit.

Get far more in QUANTITY PRODUCTION on small lathe work

...THIS FREE BOOK SHOWS YOU HOW



● This 32-page, fact-packed book contains page after page of cycle and setting-up diagrams; angular infeed turning, front or rear turning, facing, boring, angular turning, angular facing or grooving plus other engineering data and examples of actual jobs done on the new 2-A Duomatic. You'll get a new idea of the money-saving, money-making possibilities this new production lathe offers.

The Lodge & Shipley 2-A Duomatic is a smaller model of the well-known 3-A Duomatic. Just like the 3-A, this new lathe is like two lathes in one with dual tool slides, front and rear, operating singly or together. The 2-A is completely automatic—the operator merely loads the workpiece, starts the cycle, then unloads the finished piece.

Get this valuable information plus complete specifications and detailed photographs of the Lodge & Shipley 2-A Duomatic. Write on your company letterhead for Bulletin 635.

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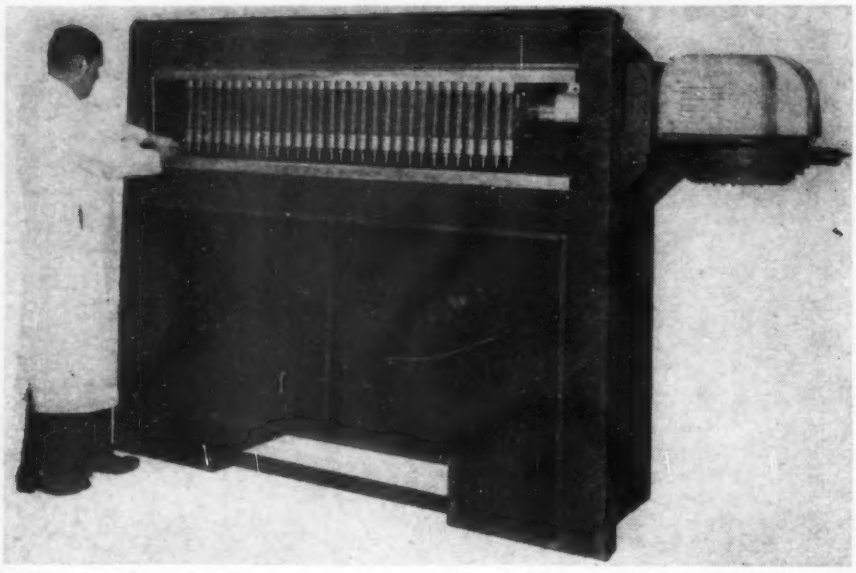
Various Guns of Progressive Unit Weld Different Metal Thicknesses



Welding rates with this "Progress-O-Matic" machine are up to 50% higher than with the Ultra-Speed welder. The control unit can be located at any position on or away from the machine

Additional information has been received on the "Progress-O-Matic" resistance welding machines built by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., which were announced in a recent issue. The machines are classified as high air-pressure operated and controlled automatic multiple spot welders. They have a high speed of operation and the various welding guns can weld different thicknesses.

An air-driven unit controls the sequencing of the entire machine, including application of welding pressure, timing of welds, and amount of welding current. Multiple cams and breakers permit a wide range of adjustment. The unit permits a combination of a wide variation of welds requiring long or short time without penalizing the complete machine cycle.

The high pressure required to operate the "Progress-O-Matic" is provided by a compressor of the Ingersoll Rand super-imposed piston type, built by the Power Plus Co. of Detroit.

Individual guns are attached or removed with a single cap screw. Each gun has two cylinders, one to apply welding pressure, the other to close the circuit.

TOOLBIT—A line of carbide-tipped toolbits for knee attachments of turret lathes is announced by Kennametal Inc., Latrobe, Pa. They are available in a range of Kennametal compositions for machining steel, cast iron, and nonferrous metals in style 11K30, 1/2 in. sq. x 3 1/2 in. long; Style 11K40, 5/8 in. sq. x 4 in. long; Style 11K50, 3/4 in. sq. and 4 1/2 in. long

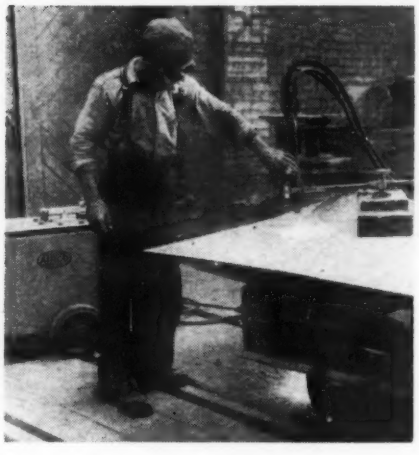
Rotoptic Circular Dividing Table Makes Optical Angle Measurement

A circular dividing table with a working surface diameter of 31½ in. is produced by the Societe Genevoise D'Instruments de Physique, and distributed by Cosa Corp., 405 Lexington Ave., New York 17, N. Y. The SIP Rotoptic has been designed for use with the Hydroptic B jig boring and milling machine. It will withstand transversal stresses due to milling work.

The worm is used only to rotate the platen, with angular measurements being made optically.

The outer edge of the platen is graduated in intervals of 1/6th of a degree for initial positioning. Precise measurements are made on a built-in graduated circle with a microscope. The platen can be rotated at 4 rpm. Rotation is by means of a motor contained in the base and controlled by pushbutton. Final settings are obtained with a knob keyed to the driving worm.

Air Reduction's Flux Injection Permits Flame Cutting Stainless



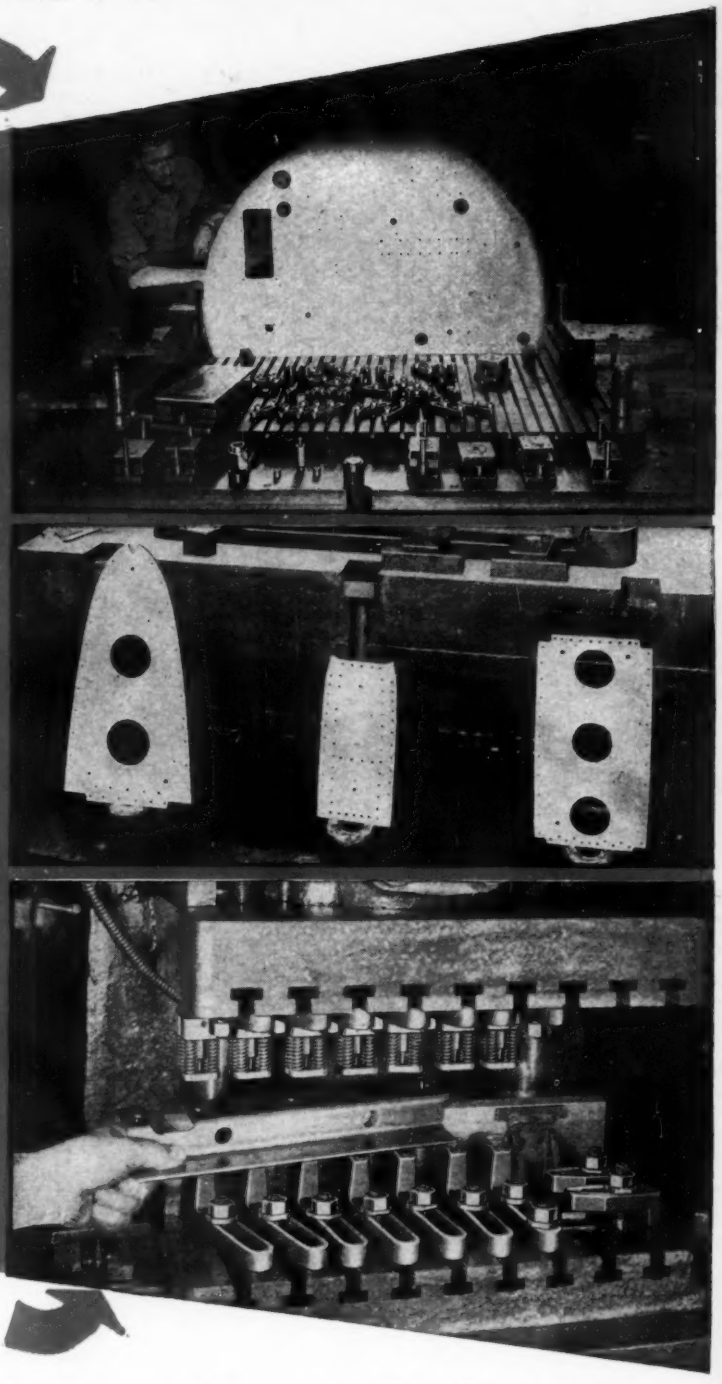
Oxy-acetylene cutting of stainless steel is possibly by the flux-injection method developed by Air Reduction, 60 E. 42nd St., New York 17, N. Y. The illustration shows the process being used at the Dominion Bridge Co., Inc., Lachine Plant, to burn 56-in. radius semi-circles from ¼ in. thick type 316 stainless. Burning was performed at the rate of 13 ipm.

Ordinary oxy-acetylene burning methods cannot be used because the formation of chromic oxides whose melting temperatures are much higher than the parent metal reduced cutting action to a slow melting of the metal. In the new method flux is introduced into the cutting oxygen streams at a predetermined rate which removes the oxides at a temperature comparable to those encountered in the burning of mild steel.

Investigations conducted by the Dominion Bridge Research Department have indicated that there was no change in physical characteristics and the stainless quality of the stabilized steel was affected to a depth of only a few thousandths.

Some examples of what can be done with Whistler Adjustable Dies. Work in practically any type press.

Re-use same WHISTLER ADJUSTABLE DIES in unlimited combinations



1 To Pierce Holes of any diameter from 1/32" up.

2 To Perforate Special Shapes.

3 To Notch Corners.

Save production time and reduce product costs by having Whistler punch and die units in your tool room.

WRITE FOR YOUR WHISTLER CATALOGS. Know the production advantages of Whistler Adjustable Dies.

Whistler notching dies, group dies and standard units are especially adaptable to combined use in the same set-up. Continued re-use in a variety of arrangements quickly writes off original investment. Reason enough for their expanding popularity with hundreds of America's best known manufacturers.

Now available from stock in a range of diameters up to 3", shipment can be made the same day your order is received. Special sizes, shapes, notching and group dies are made to order in a few days.

You get production economy plus precision perforating in practically any press with these Whistler dies. Set-ups are easy and fast. No special tools required. Heavy duty series easily pierces 1/4" steel. All parts interchangeable. Tolerances maintained to .0002". There are many other advantages. Get in touch with Whistler.

S. B. WHISTLER & SONS, INC.

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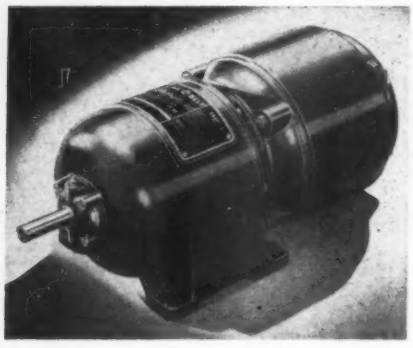
Link-Belt Electrofluid Drive Has Motor and Fluid Coupling



An Electrofluid Drive available in horsepowers up to 20 which is a motorized hydraulic combination is announced by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. It consists of a general-purpose ac. induction motor, flange-mounted to a housing containing a hydraulic coupling. The output shaft of the coupling may be connected directly to the driven machine or to a speed reducer unit. The fluid coupling, like those used in automobiles and for other purposes, has a primary and secondary element in a housing filled with a light mineral oil. When the motor drives the impeller, it causes oil to flow through the runner buckets driving the runner or secondary element.

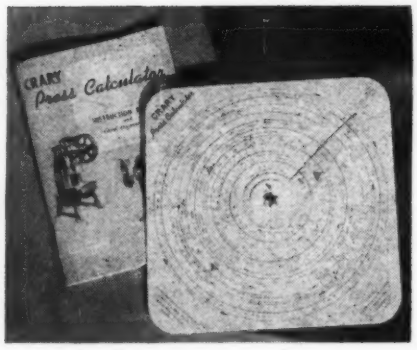
This fluid coupling serves as an automatic clutch between the motor and the driven machine. No starting control or special motor is required to solve problems of inadequate torque, or excessive high-starting current peak.

If the driven machine is stalled, the Electrofluid Drive will pull to the maximum torque capacity of the motor, drawing sufficient current to cause the thermal overload protective device to function. The fluid drive absorbs shock from the driven machine and protects the motor.

Crary Press Calculator Simplifies Press Selection

A calculator designed to simplify the selection of presses, the Crary Press Calculator, is produced by the Calculator Co., Box 65, Teaneck, N. J. The calculator was developed by Leonard R. Crary, sales engineer for the E. W. Bliss Co., and is accompanied by a 70-page booklet which largely consists of reference tables.

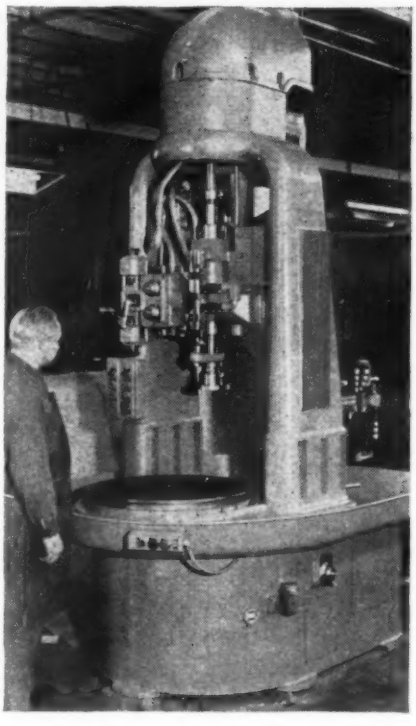
The calculator measure 9½ in. square and is made of Vinylite plas-



tic with a clear sheet of Vinylite over the printed surfaces.

For blanking operations the calculator can be used to select the correct size press by giving the crankshaft diameter and tonnage at the bottom of the stroke required to do the job. For drawing operations, it selects the correct size press by giving the crankshaft diameter and tonnage away from the bottom of the stroke and gives the maximum press speed for the particular metal being drawn. Much of the data contained on the calculator and in the booklet has not previously been collected in one place.

Edlund's Automatic Driller Has Flexible Design Features

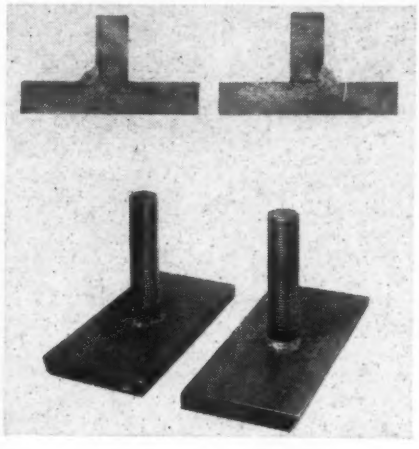


An automatic drilling machine that can be adapted to multiple operations on a variety of parts is announced by Edlund Machinery Co., Inc., Portland, N. Y. The Drill-O-Matic is said to automatically perform intricate and precision drilling, countersinking, counterboring, spot-facing, reaming and tapping operations.

The frame is mounted on standard spacers and the spindle can be elevated to any desired height by the addition of spacers. These spacers are machined for attaching standard cam feed units, special fixtures, jigs and tools. One leg of the frame is machined on the outside to mount an independently driven tapping head or other tool.

Spindle features include rapid approach, variable feed, optional dwell of selected timing, and rapid return. The automatic indexing table is 28 in. in diameter, and is normally equipped for 12 stops. It can be made with any practicable number of indexes.

Lincoln Low-hydrogen Electrode Will Weld High-sulphur Steel



A low-hydrogen electrode which simplifies the welding of high-sulphur, free-machining steel and certain high tensile, low-alloy steels, is announced by The Lincoln Electric Co., Cleveland 1, Ohio. Known as Shield-Arc LH-70, it has a low-hydrogen, low-moisture coating and is for use with dc. polarity.

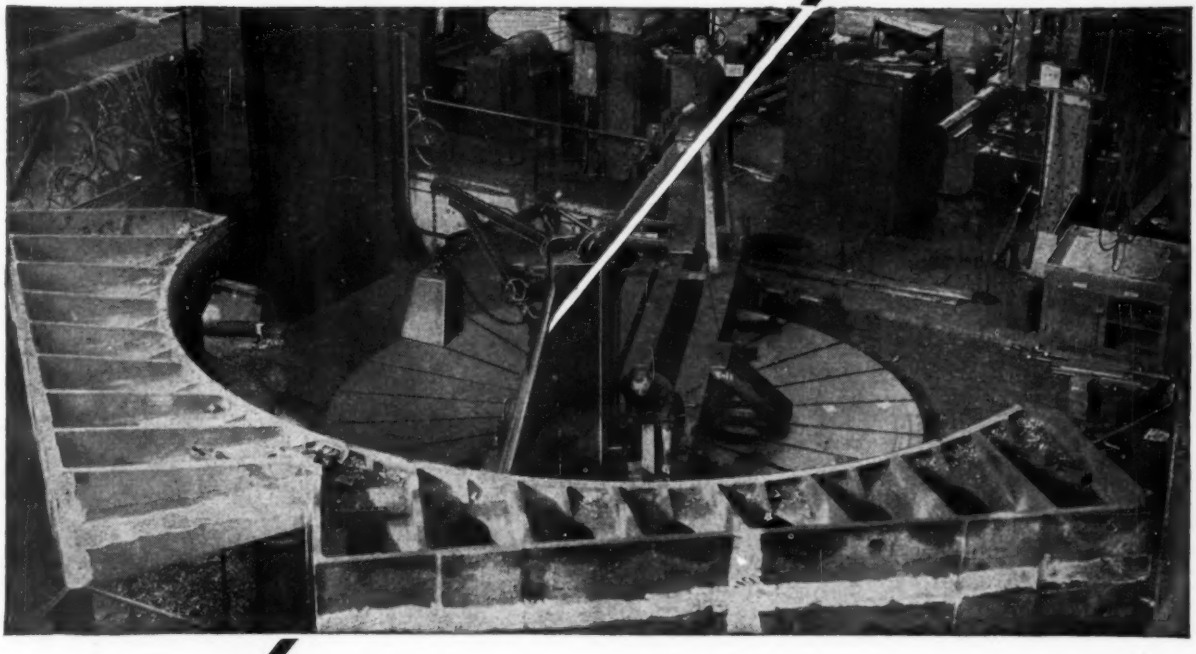
Properties of the weld are 70,000 to 80,000 psi. tensile strength and 25 to 30% elongation. High welding current and a short arc are used. Enameling may be done after welding without heat-treating.

In the samples illustrated, the cross sections are high-carbon steel and the studs welded to plates are high-sulphur steel. Welds at the left were made with present mild steel coated electrodes and the welds at right with Shield-Arc LH-70. Welds at the left indicate cracking and pitting which is absent with the new electrode.

IT'S A *New* SMOOTHIE NOW—

Dominion Engineering Works Limited, found that their 35 ft. boring mill takes heavier cuts and operates more smoothly since the table drive was re-designed to operate through Cone-Drive gearing.

This is no reflection on this boring mill—which had been operating satisfactorily for several years. But having found out how much better machinery operates when driven through Cone-Drives, Dominion is now also changing over its 20 ft. boring mill.



That's one of the surprising things about area-contact Cone-Drive gearing with its higher load capacity, greater compactness and large number of teeth in contact. Machines equipped with them invariably set new standards of smoothness, efficiency and speed for the user. Adopting Cone-Drives is the quickest way we know to make your best machines perform even better.

Ask for

Cone-Drives in Machine Tools Bulletin No. 632
Cone-Drives in Materials Handling Bulletin No. 742

CONE-DRIVE

CONE-DRIVE DIVISION **MICHIGAN TOOL COMPANY**
7171 E. McNichols Road, Detroit 12, U.S.A.

Automatic Sky Lift Truck Operates Like Automobile

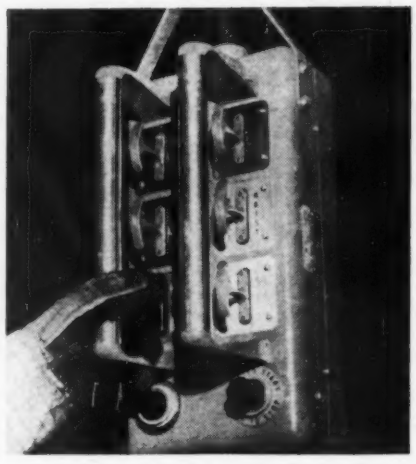
A fork truck with a lift of 130 in., the Automatic Sky Lift, is announced by Automatic Transportation Co., 149 W. 87th St., Chicago 20, Ill. Collapsed height of the truck is 83 in.

Said to be designed to meet specifications outlined by fork truck users, the Sky Lift is designed to operate like an automobile. Controls include two pedals—brake and accelerator—steering wheel and two levers to control tilt and lift, and forward and reverse directions. When the accelerator is depressed, the Newmatic controller starts the truck in first speed and automatically passes through the faster speeds.

Livingstone's Steam Generator Will Produce 65 lb. Per Hour

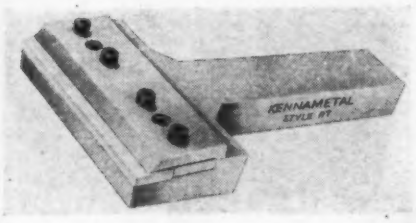
An electrically-operated steam generator to supply steam to plastic molding presses, steam cleaners, and for other uses, the Speedylectric is announced by Livingstone & Co., 89 Broad St., Boston, Mass. Pressures up to 200 psi. and volume up to 2 boiler hp. are possible.

About 65 lb. of steam per hour can be produced at any desired pressure. There is no danger of damage in case of low water because the water closes the contact between the electrodes, and in the absence of water the circuit is broken.



CRANE CONTROL — Pendant control for floor-operated cranes can be used on ac. or dc. with motors up to 15 hp. at 220 volts. Made by Control Division, General Electric Co., Schenectady 5, N. Y. The control weighs 8½ lb. and may be suspended from the trolley of the crane or hung at a distance. The pendant station has one handle for each direction of crane control, an emergency stop button which cuts off power from all crane motors, and a reset button.

Kennametal Broad-nose Tools Turn Hard Cast-iron Rolls



A line of broad-nose tools for turning cast-iron rolls up to 90 Scleroscope is announced by Kennametal Inc., Latrobe, Pa. In tests of the tools, a roll that required 25 hr. for rough grinding was turned with two 8-in. tools in 8½ hours.

The tools have solid Kennametal Grade K6 blades, held in position on an accurate surface of the supporting shank by a clamp and serrated plate. The blade has four cutting edges that may be used in succession before any sharpening is required. It can be reground on the long side and advanced until two-thirds of the material has been used. The tools are available in widths of 4, 6, 8 and 10 in.

Progressive Aluminum Flash Welder Is Powered With Storage Batteries

Additional information has been received on the storage-battery powered welders for flash welding aluminum built by the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., which were announced in a recent issue. Flash welding aluminum requires a very large welding current and rapid upset compared to other material.

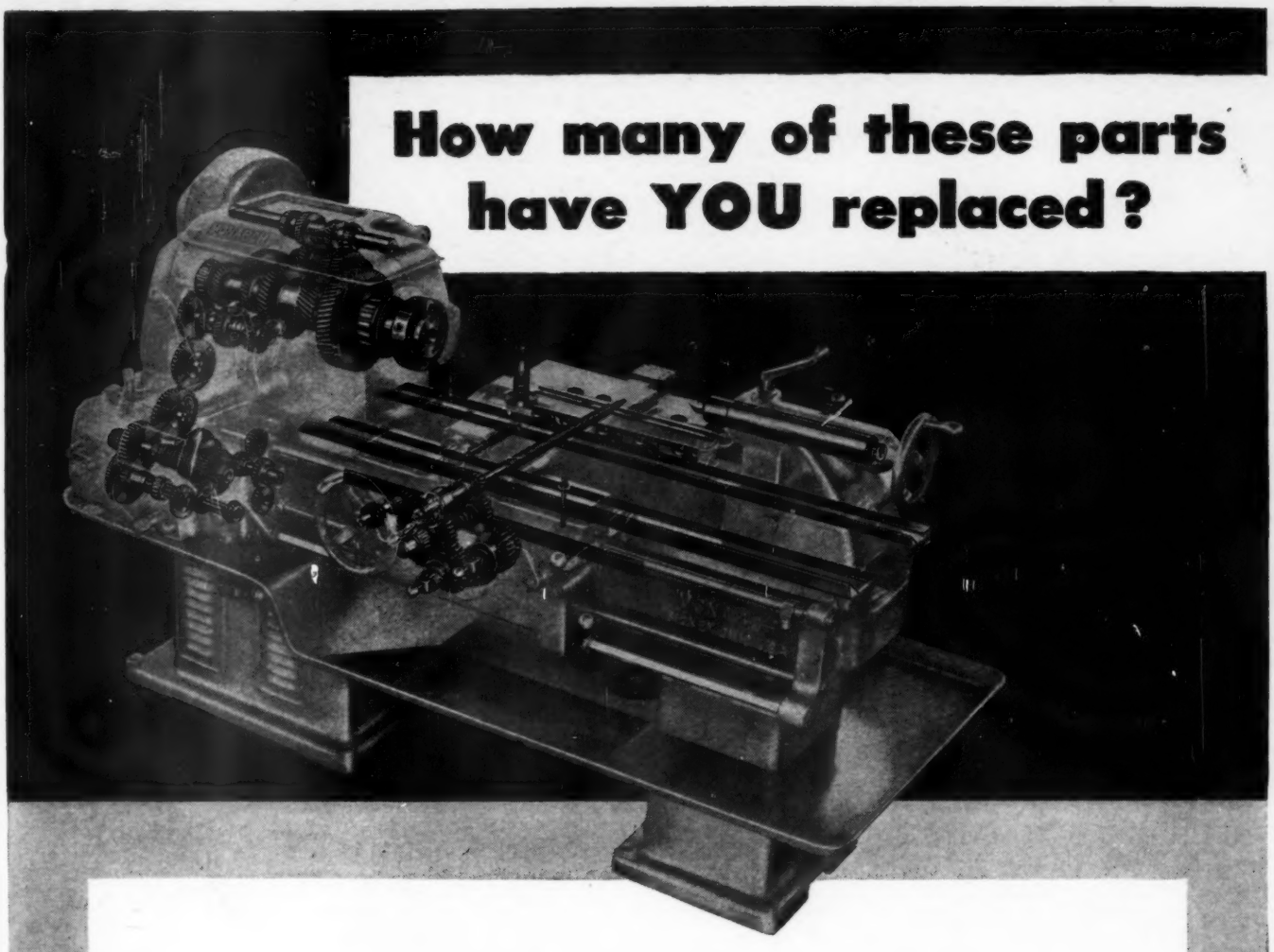
The complete machine consists of the flash welder, the battery power pack, and the battery charger and control. The power pack will supply up to 38,000 amp.

The combined use of a Reeves variable drive, a Cone-Drive gear speed reducer, and a Fawick air clutch-brake take care of the high acceleration, upset forces, and deceleration required.

Control requirements are said to be less critical with the battery-operated flash welder when welding light metals than with ac. machines. A variation of ± 20% in operating voltage or ± 30% in platen speed rate is apparently permissible without affecting weld forms. Tests are said to have shown that time may be varied from 1/20 to 1/6 sec. without affecting the weld quality.

This storage battery powered machine is flash-welding miter joints of extruded aluminum window sash. An ac. machine would require a peak load of 500 kva. single phase at low power factor for this operation. The battery-powered machine requires 18 kva. to keep the batteries charged and it can be balanced on three phases at approximately 90% power factor. This is about the power required for a 10-15 hp. 3-phase motor

How many of these parts have YOU replaced?



• If you're using a Monarch Turning Machine the answer is easy—with rare exceptions it's "*None*".

Every dark area in this phantom view indicates a hardened bearing surface or a part made of hardened alloy steel. Monarch has pioneered the use of hardened steel parts—as well as the application of different hardening processes—to lathe building. Induction-hardened lead screws—flame-hardened ways—these are two typical examples of how Monarch design gives you *peak production at a profit*—and dependable long life at sustained accuracy.

While your present lathe may offer equal protection on certain few strategic parts, no other lathe can give you the universal and all-inclusive protection features you'll find on a Monarch. The result is more universal adaptability for you.

You can change from chucking to between-centers work—from thread chasing to hogging off stock on first operations—from short-traverse precision work to large-parts production that taxes the limits of the machine—and in each case you'll get toolroom accuracy at production line speed.

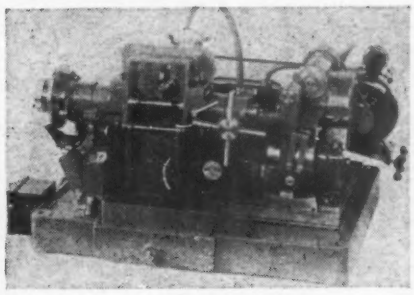
When you want the ultimate in performance, Monarch Turning Machines—*with hardened structure*—will give you the most for your money *at any price.* May we furnish more details?

ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY • SIDNEY • OHIO

Waltham Pinion and Gear Cutter Is Now Produced in Medium Size



A medium-size pinion and gear- cutting machine with a capacity up to 2¼-in. pitch diameter and 2-in. length of cut is announced by Waltham Machine Works, Waltham, Mass. It is a single cutter machine, with the revolving cutter making successive cuts on blanks held and indexed by the work spindle and supported by the tail center. Only straight pieces can be cut.

Available in bench or pedestal model, the machine is automatic in operation and stops with the cutter lifted from the work.

The standard work slide cam allows adjustment of strokes between 1.4 and 2.4 in. A shorter stroke cam is available for pinion work. Cams are changed by removing the outer bearing supports.

Salsbury Industrial Truck Line Built Around Standard Turret

A series of industrial trucks built around a "Turret" patterned after the swiveling gun turret of warplanes, is announced by Salsbury Motors, Inc., Pomona, Calif.

The Turret includes the Salsbury "Power-Package" which consists of a 6-hp. gasoline engine geared to a drive wheel through a fully automatic clutch and transmission.

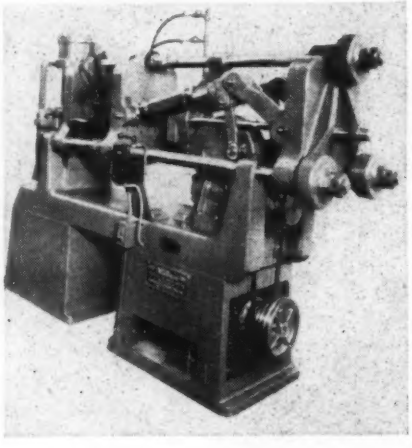
The turret can be turned to provide power in any direction. The automatic transmission shifts down for heavy loads and gears up for light pulling, eliminating gear shifting. No reverse is needed since the turret turns completely around.

Fleet operators can have a spare turret which can be installed in a truck in less than 30 min. Three models now in production are the Turreteer, a platform-lift truck which will pick up a load from standard skids; the Turretug, a shorter tractor built for trailer systems; and the Turretruck, a toggle truck with a large deck.

Chicago-Latrobe Masonry Drills Are Carbide-tipped, Rotary Type

Carbide-tipped masonry drills are being produced by Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill. They are available in a range of sizes from 3/16 to 1½ in. in diameter. They are furnished oversize to provide for clearance in the installation of anchors, expansion and toggle bolts.

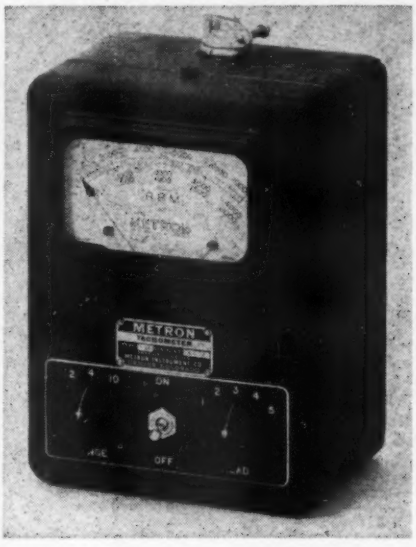
Light Metal Machinery Die Caster Has 720 Automatic Cycles Per Hr.



Improvements in the automatic die-casting machine for zinc, lead, and tin castings are announced by Light Metal Machinery Co., Inc., 736 Penton Bldg., Cleveland, Ohio. The delay between cycles is eliminated by a patented cycling mechanism that provides automatic die movement, shot and ejection in continuous cycles. Once the cycling range has been set, production rate is automatic, and the operator merely fills the melting pot and lubricates the die.

Production rates with single cavity dies are said to be greater than in large, manually-operated machines. Time for changing dies is said to average 15 min.

Metron Switchboard Tachometer Checks Speed of Five Machines



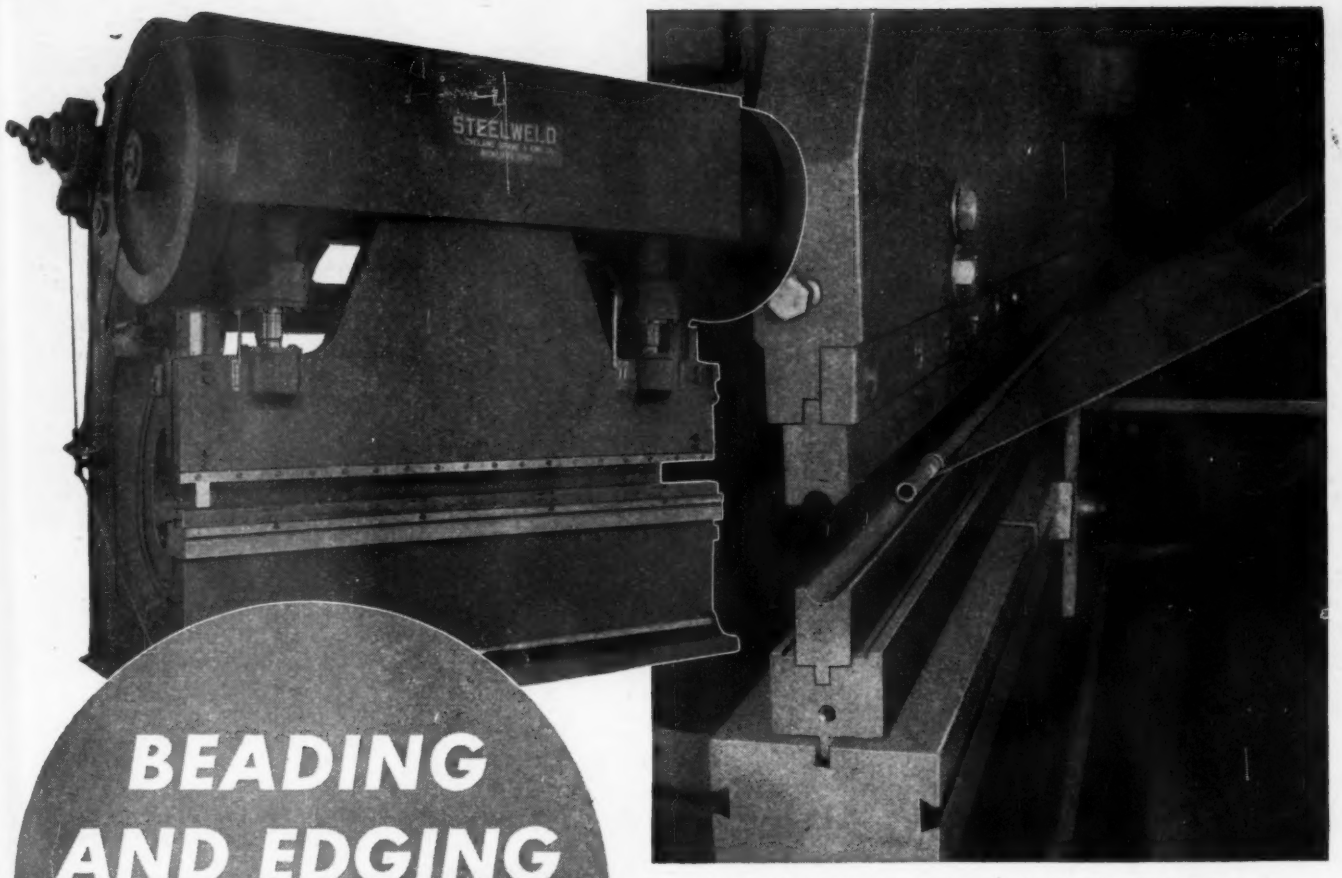
A switchboard tachometer Type 40E with five heads and three speed ranges is produced by Metron Instrument Co., 432 Lincoln St., Denver 9, Colo. Tachometer heads can be mounted at five different machines. A rotary selector switch on the indicating unit selects the machine whose speed is to be measured.

The scale shows three separate speed ranges from 1 to 50,000 rpm. A rotary selector switch is used to select the desired range. The tachometer employs neither generator nor magneto. The tachometer head is a reversing switch actuated in both directions by a cam mechanism. It alternately charges and discharges a condenser through a milliameter, causing the milliameter to deflect in direct propportion to the speed of rotation of the tachometer shaft.

Elwell-Parker Fork Truck Has 18-ft Elevating Reach

A fork-lift power truck with an elevating reach of 18 ft. is announced by Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 14, Ohio. Previous models have had a lifting range up to 10 or 12 ft., with a few special models going as high as 16 ft.

The truck has a capacity of 4,000 lb. up to 11 ft. and 3,000 lb. to 18 ft. It will pick up loads directly on the fork or on pallets. The upright columns may be tilted 15° backward and 5° forward. Lifting speed is 13 fpm., and lowering speed 20 fpm. Traveling speed of the truck is 5 mph.



This illustrates how simple it is with a Cleveland Steelweld to wrap the edge of a steel panel around a pipe to secure rigidity and good product appearance.

BEADING AND EDGING PERFORMED EASILY . . . ON STEELWELDS

Beading and edging operations are only a few of the many types of work that are easily performed on Cleveland Steelwelds. Bending, forming, louvering, punching and notching are done with equal facility.

Steelweld Presses are so designed that dies may be changed easily. Gauges and indicators provided, make it simple to obtain identical results repeatedly, with a set of dies.

A complete line of Steelwelds is available for plates of all thicknesses up to one inch and lengths to 20 feet. If you work with steel, aluminum or the many alloy metals, it will pay you to investigate the possibilities of these modern presses.

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CATALOG No. 2002 gives complete construction and engineering details. Profusely illustrated.

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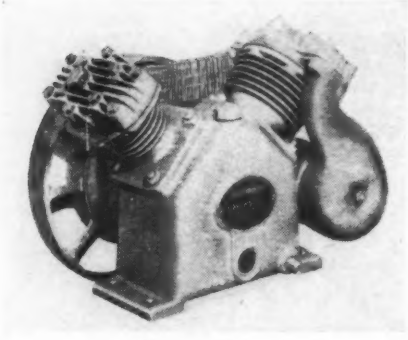
CLEVELAND
STEELWELD PRESSES
BENDING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

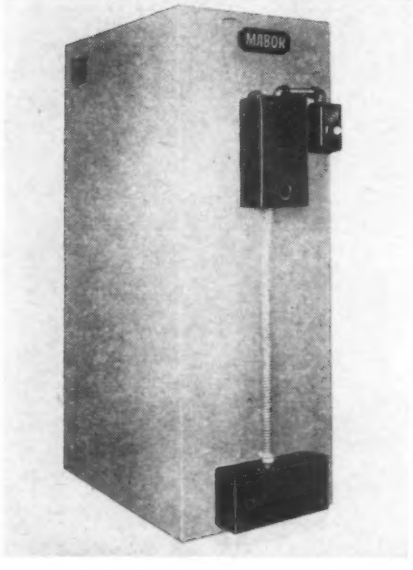
Worthington Compressor Line Fits Established Motor hp.



The Air King line of air compressors, designed for established motor horsepowers is announced by Worthington Pump and Machinery Corp., Harrison, N. J. It includes single-stage, and two-stage sizes for pressures up to 250 psi. and for mating to standard motors from 1 to 15 hp. Models are also available which include the motor. Air compressors are available for either direct or V-belt connection to drivers.

A new principle for automatic starting involves a centrifugal clutch which permits the driving motor to attain full speed before the compressor turns. This eliminates the need for starting unloaders, check valves, release and leader valves.

Mabor's Portable Degreaser Has Built-in Storage Tanks



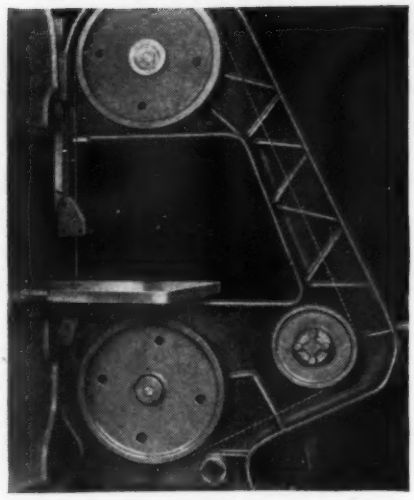
A vapor degreaser which is completely self-contained and can be used as a portable unit is produced by Mabor Co., Clark Township, Rahway, N. J. The unit can be equipped with castors and requires only a plug into a power source to start its operation.

Built-in storage tanks are provided. The contents can be distilled without danger of overheating because of a jacket heating system. The flow of cooling air is increased to reduce vapor-level oscillation. A hand hose and flush pump are supplied for light metals which do not condense enough solvent vapor for effective cleaning.

Twelve Speeds 85 to 1750 fpm. Are Available in Ermac Bandsaw

The Cerny bandsaw with 12 speeds from 85 to 1750 fpm. is announced by Ermac Co., 5531 S. Vermont Ave., Los Angeles 37, Calif. This range is said to suit the saw to any material.

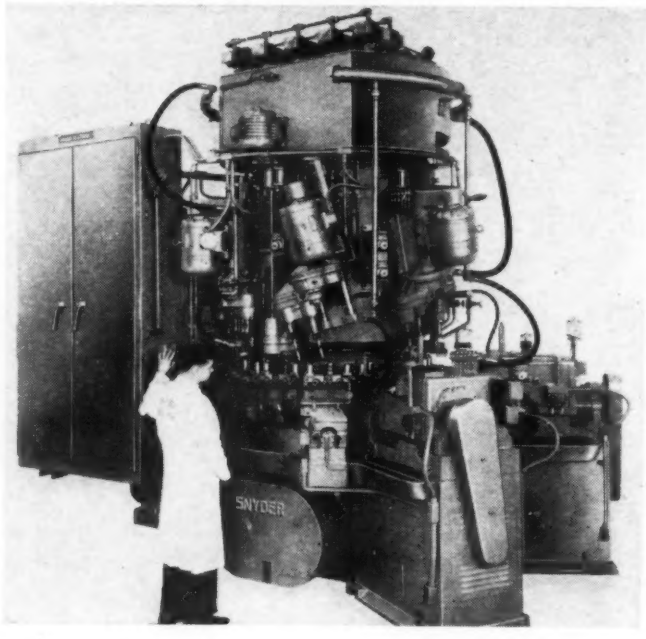
The throat depth is 17½ in. and the distance from table to guide 10½ in. The 20 x 20 in. table will



tilt to 45°. The design is said to eliminate the possibility of injury through blade breaking.

Blades from 98 to 102 in. in length are handled. The saw is available with ¾ hp., 900 rpm. motor.

Snyder Builds Special Unit To Machine Connecting Rods



The control panel of this special machine for connecting rods includes the cycle start button, emergency return button to withdraw all units from the work, and individual unit cycle button for tool set-up

Automotive connecting rods are completely machined except for the bearing cap joint faces and crank and wrist pin holes in a special machine designed and built by Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. The connecting rods are milled, sawed, drilled, reamed, tapped, countersunk, counterbored and burred.

Dual work-holding fixtures are mounted on a 12-station Geneva index table. Production at 80% of rated efficiency is 266 rods per hour.

The machining units have individual motors, driving through a change-gear box and V-belts. The tapping head is traversed to and from operating position hydraulically, and fed by a lead-screw for the work stroke. All other units are hydraulically fed. The cutters, counterbores and countersinks are provided with arbors and special adjustable tool holders. Other tools are mounted in standard adjustable tool holders. High-speed steel tools operating at 60 sfpm. are employed.

NEED
MORE STEEL?
You can help by keeping your scrap moving back to the mills.

FOR INCREASED TOOL LIFE—
LOW COST—ACCURATE PARTS USE
J&L COLD FINISHED STEEL

Your automatic screw machines will operate longer between tool changes when you use J&L Cold Finished steel. The uniform Controlled Quality of J&L Cold Finished rounds, hexagons and squares makes it possible for you to set the speed of your machines to obtain maximum efficiency. In addition the close dimensions and inherent machinability of J&L Cold Finished bars will make it possible to produce, at low cost, accurate, highly finished parts.

JONES & LAUGHLIN STEEL CORPORATION

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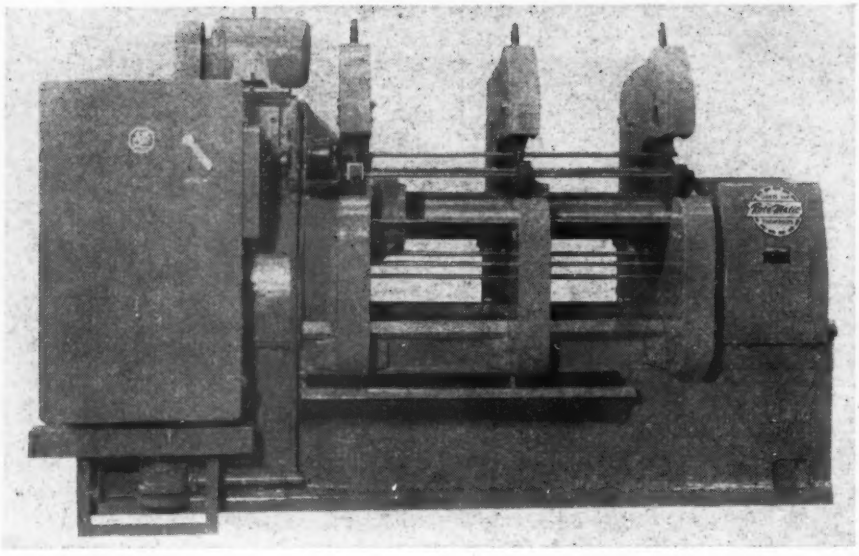
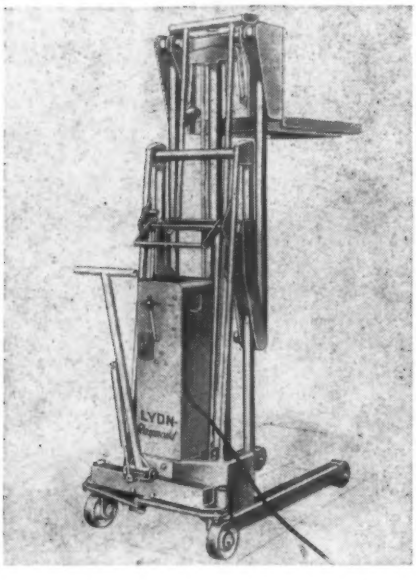
J&L STEEL



SHAFT MILLING—Index-type special machines for milling and spinning shafts, developed by the Davis and Thompson Co., 64 W. Burnham St., Milwaukee 14, Wis. The model shown has 8 stations for rough and finish milling one end of steering shaft and deburring and spinning a rivet head for holding the steering worm. Indirect chain clamping permits the operator to load and unload pieces as the stations pass him. Each indexing of the fixture delivers a finished piece to the loading station. Heads of the machine are fed hydraulically and all other functions are performed electrically. Production is 300 pieces per hour

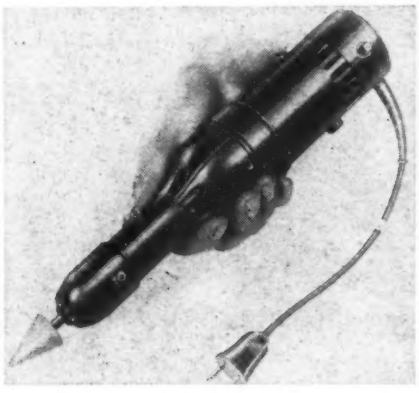
Lyon-Raymond Hydraulic Unit Can Be Added to Lift Truck



A hydraulic power unit for installation on their high-lift truck is announced by Lyon-Raymond Corp., 2882 Madison St., Greene, N. Y. The power unit consists of electric motor, hydraulic gear-type pump, valves, oil reservoir and controls. It is available with ½ or ¾ hp. motor, depending on the capacity of the truck and speed of elevation required.

The power unit is furnished with 25 ft. of cable. A self-winding cable reel is available as extra equipment. A release valve in the hydraulic system prevents overloading.

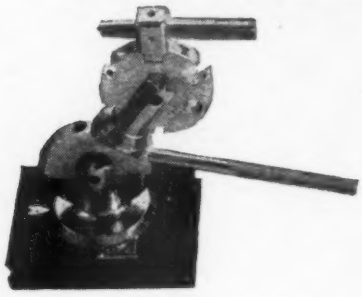
Precise Electric Hand Tool Has Speeds to 40,000 rpm.



An electric hand tool and portable grinder, Precise-40, which is capable of speeds to 40,000 rpm., is announced by Precise Products Co., 1328-30 Clark St., Racine, Wis. The tool has a 1/5 hp. motor and weighs 40 oz.

The quill is fitted with a No. 0 Morse taper for interchangeable mounting of collet chucks or Jacobs chuck for special spindles. The unit can be used as a hand tool or mounted in a stand, vise, lathe, or milling machine.

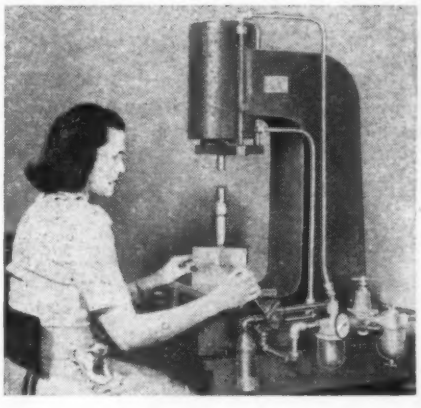
Allied Machinists' Fixture Is for Tool, Wheel Dressing



A tool and wheel dressing fixture, Gem-Flex, is announced by Allied Machinists, 6 Water Street, Waltham, Mass. The dresser is said to offer accuracy equal to the height gage. It can be used to form any angle and a number of inside and outside radii.

A special indicator on the base indicates the vertical axis when adjusting diamond clearance. Toolbit slot capacities are 3/16, ¼, 5/16, ⅜, and 7/16 in.

Studebaker Machine Arbor Presses Have Double-acting Air Cylinders

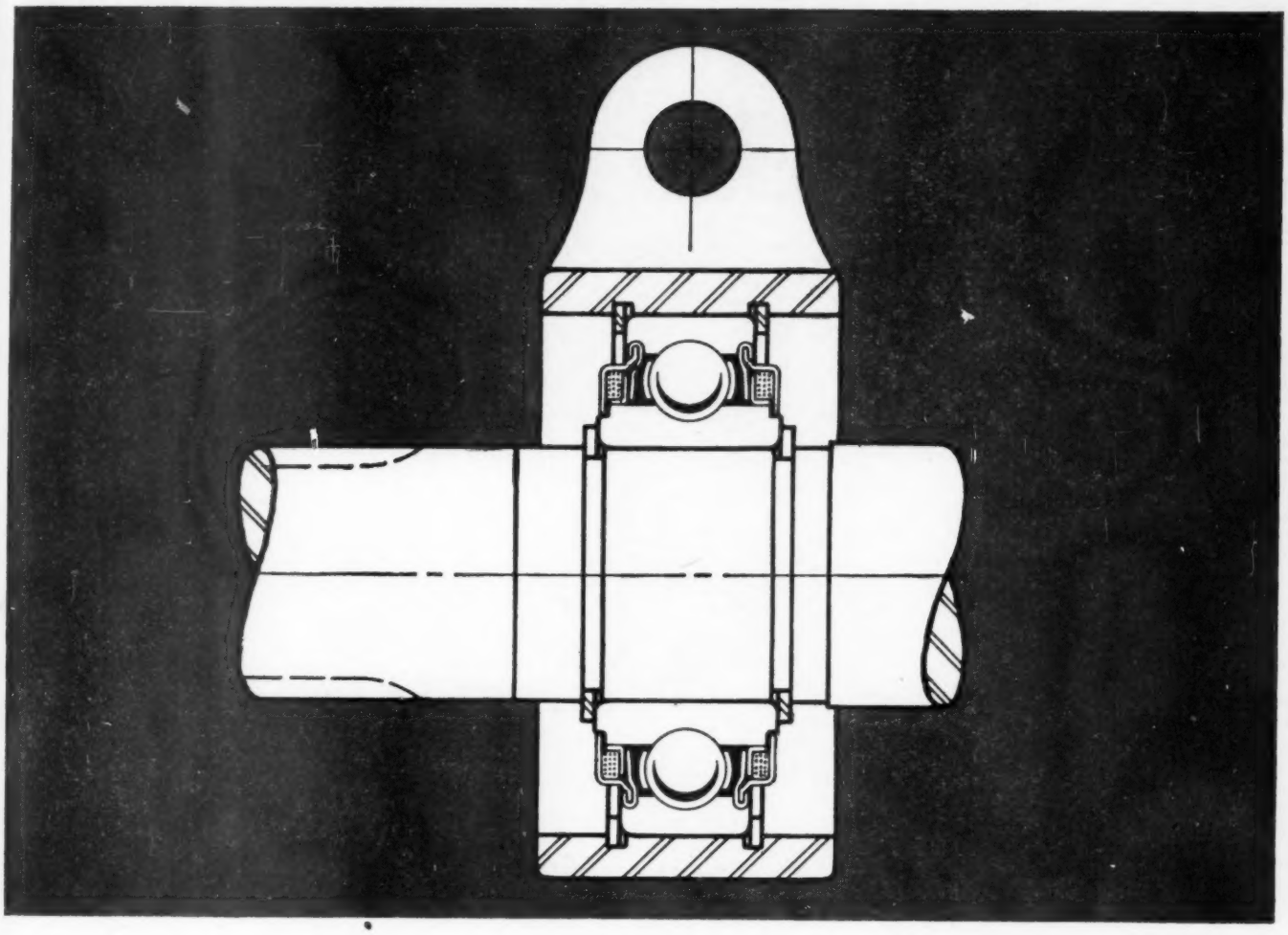


Two air-powered arbor presses of steel welded construction are announced by the Studebaker Machine Co., 1221 S. 9th Ave., Maywood, Ill. Double-acting air cylinders are used on both models with up to 200 sharp punch press ram blows per minute possible.

The Hurricane 6 develops 1-ton ram pressure on the down and up strokes at 80 psi. air line pressure. With 120 psi. air line pressure, 1½-ton pressure is developed. The Hurricane 8 develops 2 and 3 tons at 80 and 120 psi. air line pressure.

The ram pressure can be pre-set from a few pounds to the maximum, and the stroke can be regulated from a few thousandths to six inches. Lever, pedal, or solenoid control can be used.

How creative engineering cuts ALL upkeep



● By originating and perfecting the self-sealed and Lubricated-for-life ball bearing, New Departure has made it possible to eliminate *all* maintenance work for a great number of important bearing positions in machinery of all sorts. No lubricating, no adjusting—no attention of any kind required.

And—as in the power take-off shaft shown, not only can the owner forget the bearing entirely, but the machine builder, with no separate seals or lubricating fixture to fit and no drilling or tapping needed, can save in lower manufacturing cost.

New Departure creative engineering benefits machine user *and* builder.

Nothing Rolls Like a Ball

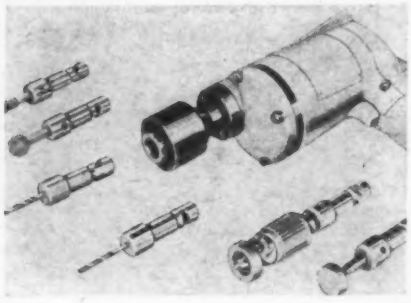
NEW DEPARTURE

BALL BEARINGS

3484

NEW DEPARTURE • Division of GENERAL MOTORS • BRISTOL, CONN. • Branches in DETROIT, CHICAGO, LOS ANGELES and Other Principal Cities

With Rayco High-speed Chuck Tool Is Changed with Power On



A high-speed production chuck for drill press and hand power tools which permits quick tool changes without shutting off the power is produced by Rayco Mfg. Co., 3911 S. Prairie St., Chicago 15, Ill. Centrifugal force is used to move a ground and hardened driver into the adapter slot. It is said that the chuck will operate in all positions at any feed.

An upward movement of the outer sleeve of the chuck releases the centrifugal driver and permits withdrawal of the adapter and tool. When the next tool and its adapter are in place, the sleeve is moved downward to release the driver.

Steel City Testing Machine Holds Maximum Gage Reading

Model TR-1 transverse testing machine with a capacity of 10,000 lb. is announced by Steel City Testing Laboratories, 8843 Livernois, Detroit 4, Mich. The machine is hydraulically operated with the load applied automatically at speeds to suit the operator.

A special gage with maximum indicating hand is supplied which remains stationary when the specimen breaks, permitting the operator to get accurate readings even though he is not looking at the dial when the ultimate breaking point is reached. The machine has a 24-in. maximum span and a 4-in. opening.

Ruthman Machinery's Pump Placed Horizontal or Vertical

Model 2-C ball bearing, motor-driven pump, known as Rumac, is announced by the Ruthman Machinery Co., Cincinnati 2, Ohio. The pump will handle 70 gpm. at a total head of 22 ft. when equipped with ¾ hp., 1725 rpm. motor.

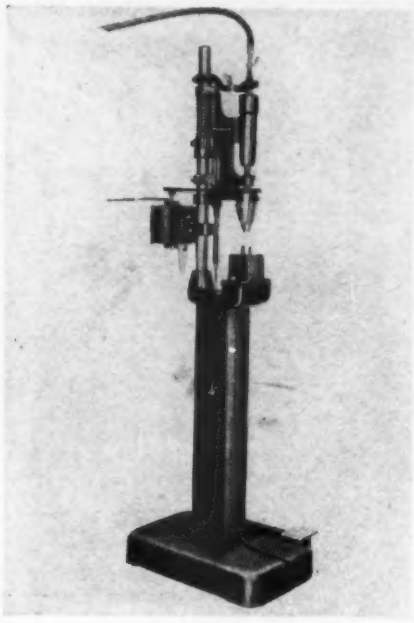
The pump can be installed either below or above the reservoir in a horizontal or vertical position. It can be converted to pipe inlet type by use of a pipe adapter plate available in several sizes. Other models will be available from ¼ to 2 hp.

Lincoln High-carbon Electrodes Used with Alternating Current

High-carbon electrodes which can be used with most ac. and dc. transformers for building up worn steel parts by welding are announced by the Lincoln Electric Co., Cleveland 1, Ohio. Electrodes are designated Hardweld 50 ac., and 100 ac. to distinguish them from the regular Hardweld 50 and 100 which operate only on dc.

The electrodes have a heavily extruded shielded-arc coating and are said to produce flat, smooth beads with deposits that can be hot forged. Hardness of the deposit from Hardweld 100 ac. is 20 to 45 Rockwell C, and with Hardweld 50 ac. is 20 to 35 Rockwell C.

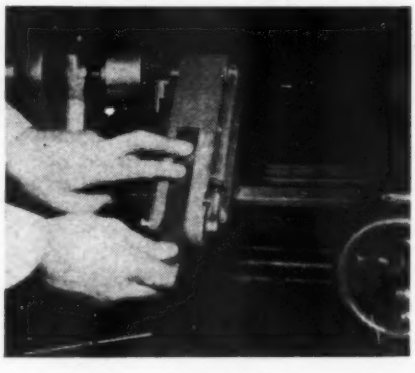
Schlack's Pneu-Spin Riveter Has 4 Interchangeable Heads



The Model PS Pneu-Spin riveter has been improved to provide four interchangeable heads. Produced by Schlack Mfg. Co., 13255 Birwood Ave., Detroit 4, Mich., the head capacities based on solid soft steel rivets are size 62, 3/32-in. capacity, size 75, 5/32 in.; size 100, ¼ in.; and size 125, 5/61 in.

Operating on 75 to 80 psi. air pressure, the heads impart 4000 to 6000 short ¼ in. blows per min. to the rotating spindle and peening tool. The force and frequency of blows is controlled by the air valve.

Johnson Portable Belt Sander Can Be Driven by Electric Tool

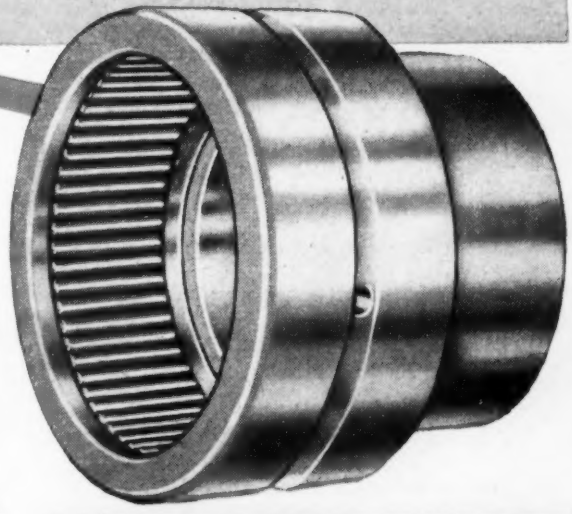


A portable sander that incorporates all the principles of a belt sander except the power plant, is produced by Johnson Mfg. Co., Lincoln Park, R. I.

The frame is constructed of aluminum and uses standard belts. It can be mounted in a lathe or drillpress or powered by a portable tool.

ORANGE ROLLER BUSHINGS contribute smooth, friction-free operation in heavy duty transmission of GALION TANDEM ROLLERS

● Galion Variable Weight Tandem Rollers (5 to 14 tons) are used for precise compaction of road building materials. To meet this rugged service, Galion Rollers are scientifically engineered, well-balanced, easily operated. To provide smooth, efficient transmission of power, Orange Roller Bushings are installed on the cross shafts in the heavy duty transmission.



THE NO. 1 JOB of Orange Roller Bushings is to eliminate friction on rotating parts . . . under heavy load or at high speed. And at the same time, to provide smooth, quiet running and long-life operation. They've had remarkable success in this job on all types of machinery and equipment whose requirements are unusually severe.

Wherever you need friction-free operation in your equipment, install Orange Roller Bushings. Their high load-carrying capacity in small space permits compact design and gives ample overload margin. Their closer internal running clearances minimize mis-alignment of rollers, providing even, quiet, trouble-free running.

Orange Roller Bushings are made in a full range of sizes and types for most requirements. Write for Engineering Data Book giving design, dimensions, capacities, installation data, etc.

ORANGE ROLLER BEARING CO., INC.
554 Main Street, Orange, N. J.

Mail Coupon for Engineering Data

Orange Roller Bearing Co., Inc., A.M.
Orange, N. J.

Please send me your Roller Bushing Data Book.

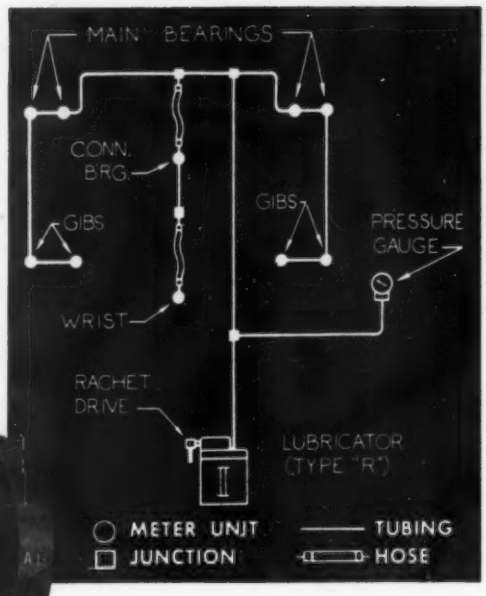
Name.....Title.....

Company.....

Address.....

City.....State.....

CASE HISTORY
No. 285
from the
BIJUR FILES



"BLISS" No. 30 *Inclinable Press*

SPECIFICATIONS

LUBRICATOR:
Cyclic type
Drive from press slide
Reservoir capacity—3 pints
Discharge volume—1 ½ cubic centimeters
Pressure—45 lbs. per sq. in.

DISTRIBUTION:
Number of meter-units—10
Tubing—5/32" O.D. x .020 wall steel

Standard equipment on a wide range of machines in the metal-working industries is a built-in Bijur system of central lubrication. This system is *automatic*, starting and stopping with the machine. At infrequent intervals, the operator fills the lubricator . . . the rest of the time he can devote full attention to production while the system meters to each bearing the correct amount of oil *automatically*. No shut-downs for lubrication . . . no "forgotten" bearings . . . no "feast and famine" periods. Production is up — maintenance costs are down.

BIJUR LUBRICATING CORPORATION
Long Island City 1 • New York

BIJUR
AUTOMATIC *Metered* LUBRICATION

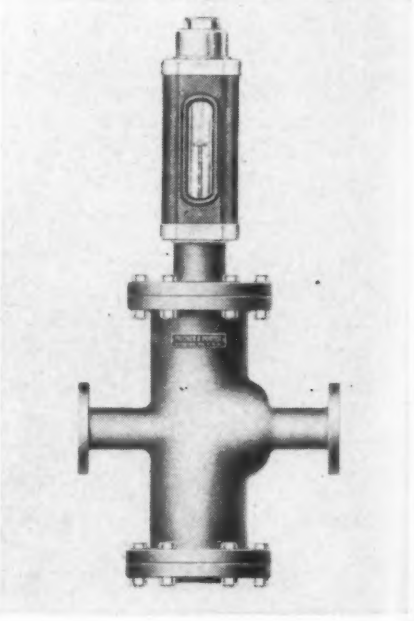
FOR FURTHER DETAILS WRITE FOR BULLETINS 3B AND 4A

Parts and Materials

Sorenson Voltage Regulator Has Range of 360-500 Cycles

The Model D-500 ac. voltage regulator for general industrial application is produced by Sorenson & Co., Inc., Stamford, Conn. The unit has a frequency range of 360 to 500 cycles, input voltage range 95 to 125, and output voltage range 110 to 120. Regulation accuracy of the unit, which weighs 12.5 lb., is 0.5%. It will operate in temperatures ranging from —55 to + 70 C.

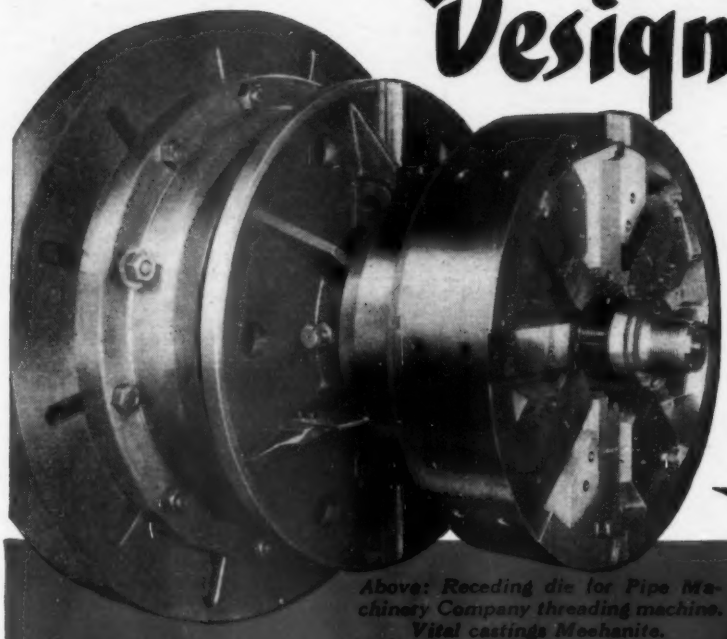
Fischer & Porter Flowrators Armored for Hazardous Use



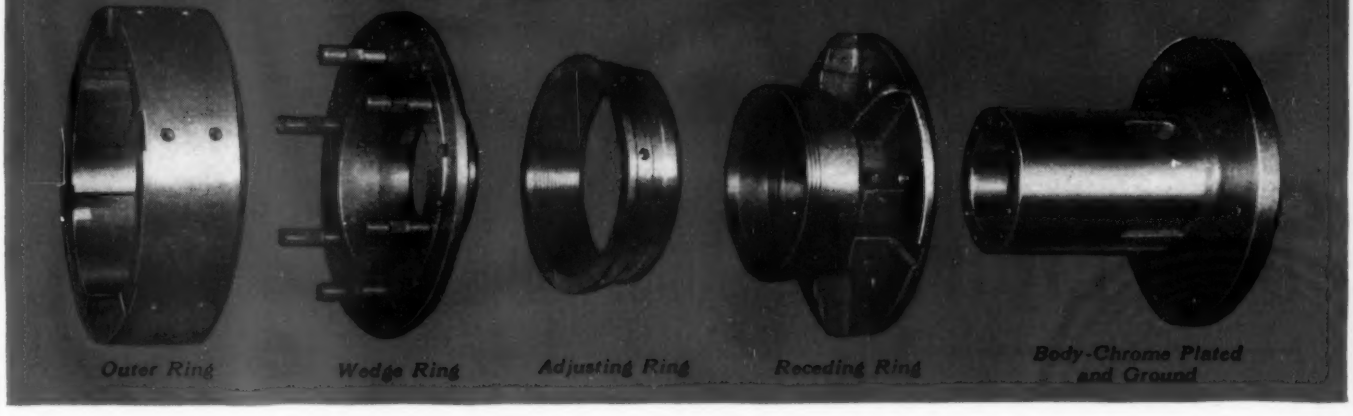
For use where high pressures, high temperatures, the possibility of liquid hammer, or the handling of hazardous gases or liquids makes

Designed to be better with

MEEHANITE CASTINGS



Above: Receding die for Pipe Machinery Company threading machine. Vital castings Meehanite.



Write for our Bulletin No. 22 "Stories of Meehanite in Industry."

Only quality, high precision machinery is produced by The Pipe Machinery Company, Cleveland, Ohio. Outstanding in their line is pipe threading equipment producing API quality threads.

Illustrated is a receding chaser die for pipe threading and the five *important* Meehanite Castings embodied in its construction.

Note that the body casting is chrome-plated and ground, to extremely close tolerances. All these Meehanite Castings are produced in Type GA Meehanite providing a minimum tensile strength of 50,000 psi (1.2" diameter test bar), uniformly solid, dense and machinable castings, which maintain their original accuracy permanently.

When analyzing the component parts of your equipment be sure you are acquainted with the superior properties and high quality which can be built into it with Meehanite Castings.

"Meehanite *Means* Better Castings"

MEEHANITE

Pershing Square Building
New Rochelle, N. Y.

NICHOLSON
U.S.A.
MADE IN U.S.A.
SUPERIOR
TANGED type (left) for use with conventional handle. Rigid only. Flat, Pillar, Square and Half Round.
BLADE type (above) for use in special holders. Flexible and Narrow Flexible—for convex and concave surfaces. Rigid in Half Round, Shell and Mouilding.
Popular sizes—8", 10", 12" and 14".

SUPERIOR in more than name

THE tremendous and still-growing use of light-but-strong manufacturing materials means correspondingly greater need for "shearing" type files.

These files reach their highest perfection in Nicholson Curved Tooth Files. Improved milling machinery—made only by Nicholson—forms the teeth with *superior* accuracy, *superior* sharpness, and with a uniformity never before achieved in files of this type.

Special attention has been given to proper rake and clearance. Correct curve provides smooth action and the double shear makes it easy to prevent file running off the line. Exclusive Nicholson hardening and toughening methods keep the teeth cutting longer.

Superior quality fully justifies the name of these files—*Nicholson Superior.* And their application is wide. They can be used on cast iron, sheet steel and commercial annealed tool steel—as well as on aluminum, magnesium, babbitt, brass, lead and soft alloys; on plastics, hard rubber and wood. There are *standard, fine* and *smooth* cuts—for fast metal removal down to fine-finishing of brass, phosphor bronze and sheet aluminum; for lathe, die, tool and extra-smooth work.

⬇ ⬇ ⬇

You can get Nicholson Superior Curved Tooth Files NOW. Order through your industrial distributor. Special inquiries will be given prompt and cheerful attention.

NICHOLSON U.S.A.

NICHOLSON FILE CO. • 29 ACORN ST., PROVIDENCE 1, R. I.

(In Canada, Port Hope, Ont.)

BLACK DIAMOND TRADE MARK

NICHOLSON FILES FOR EVERY PURPOSE

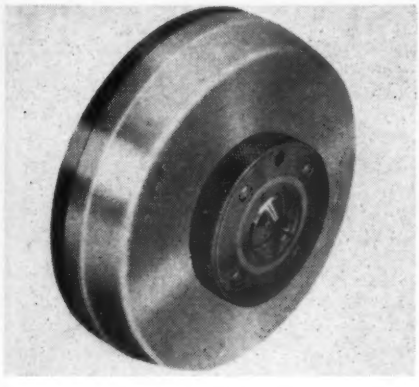
the use of Rotameters with exposed glass tubes dangerous or impractical, a line of armored Flowrators is announced by Fischer & Porter Co., Dept. 4C-7, Hatboro, Pa.

Construction of the unit permits direct horizontal installation into the piping system. It may be obtained as a standard flow-rate indicating meter, or as a recording-controlling or totalizer meter.

Texaco Drawing Compound No. 2 Can Be Washed Off with Water

A new drawing compound, Texaco Drawing Compound No. 2, has been developed by the Texas Co., 135 E. 42nd St., New York 17, N. Y. Adapted for stamping and drawing operations, it has a paste-like consistency and is said to be easily washed from the completed work pieces with water.

Modern Collet's Almco Jet Chuck Has Adjustable Gripping Pressure

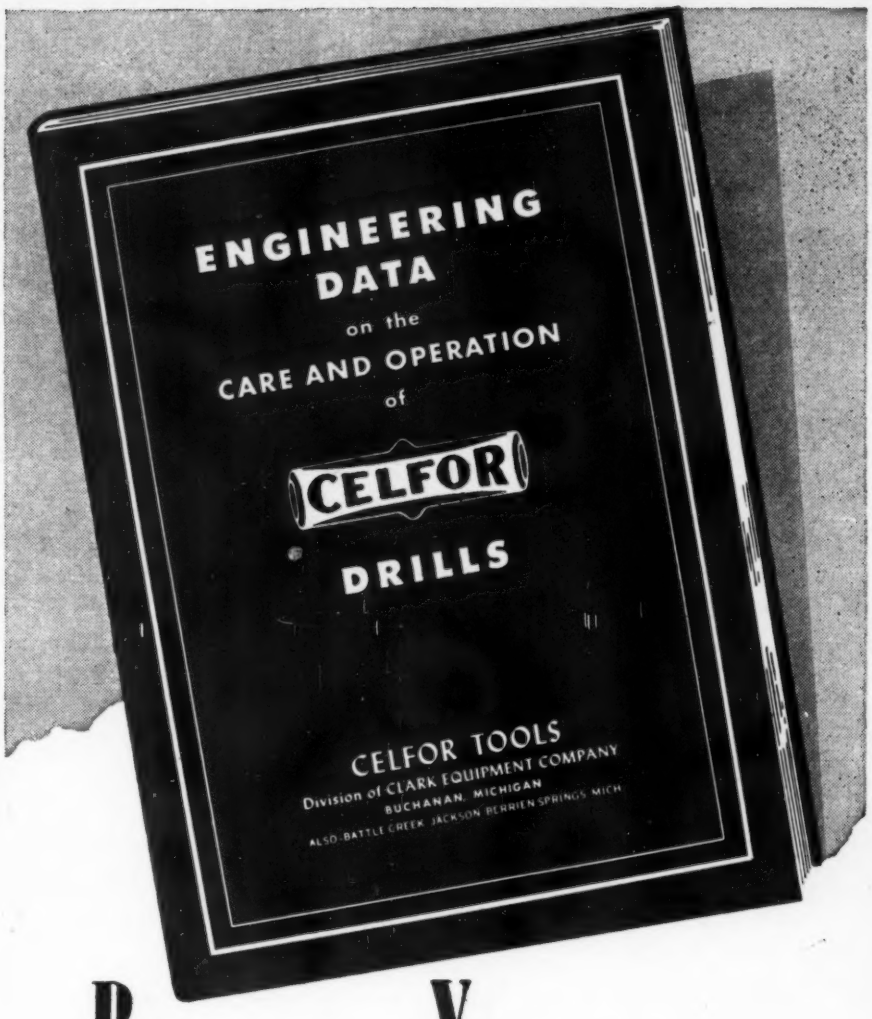


A collet chuck for hand screw machines and engine lathes up to 1-in. capacity is announced by Modern Collet and Machine Co., 401 Salliotte St., Ecorse, Mich. Gripping pressure of the Almco Jet-type chuck is adjustable in 12 steps from 0 to 15,000 lb.

The collet is closed by a spring action and opened by compressed air from 100 psi. line pressure. This eliminates danger of the chuck opening in case the air pressure fails. The chuck has a length of 2¼ in. and weighs 11½ lb.

Detroit Tap and Tool Products Are Made with New M-11 Steel

A chrome-cobalt, high-speed steel specially developed for taps and threading tools, known as M-11, is being used by Detroit Tap and Tool Co., 8432 Butler St., Detroit, Mich., for its complete line of standard and special taps. The new steel is said



BOOK OF THE YEAR *for men who sell, use and care for* TOOLS

It sticks strictly to useful facts concerning tools — how to use and maintain tools in order to get maximum efficiency and long life. The idea back of it was to produce the best book of its kind ever compiled—and we believe it is just that.

A Good Book to Keep Handy

Glad to send you a copy if requested on your business letterhead.

CELFOR TOOLS
Division of CLARK EQUIPMENT COMPANY
BUCHANAN, MICHIGAN
OTHER PLANTS - BATTLE CREEK, JACKSON, BERRIEN SPRINGS, MICHIGAN

Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
INDUSTRIAL TRUCKS AND TRACTORS • HIGH-SPEED DRILLS AND REAMERS
METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

Prices on CLARK products will not be advanced in excess of increased costs

Quick, Accurate Readings...

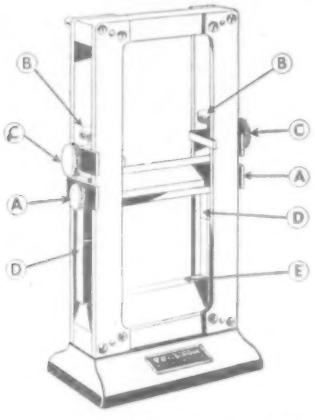
with the

ELLSTROM

INTERNAL SETTING GAGE!

Set Your Internal Gages Quickly, Easily, Accurately!

Don't waste time with clamps and parallels in setting your internal instruments and gages! Use the ELLSTROM Internal Setting Gage! It's designed especially to give you faster, more accurate readings over a wide range of applications . . . on the job or in final inspection. In many cases it eliminates the need for master ring gages!



Made of finest steel . . . with all gaging surfaces processed and finished to millionths in flatness, the ELLSTROM Internal Setting Gage provides the ultimate in accuracy with minimum adjustments.

Available in two sizes . . . one with 6" range, the other with 10" range.

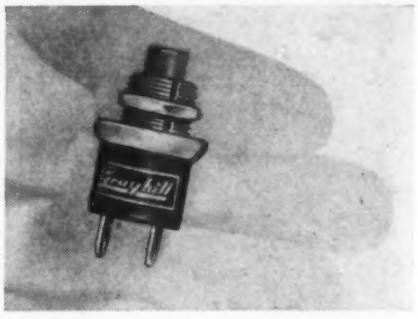
Write today for descriptive literature and prices.

DEARBORN GAGE CO. 22038 BEECH STREET DETROIT, MICHIGAN

Originators of Chromium Plated Gage Blocks

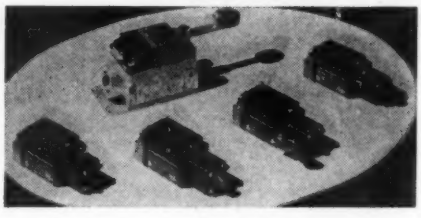
THE WORLD'S finest STANDARDS

to have higher resistance to abrasion, higher toughness with high hardness, higher red hardness, and higher torsional strength than the steel previously used.



PUSHBUTTON SWITCH—Series No. 4000 switch has momentary contact with automatic return. Produced by Grayhill, 1 N. Pulaski Rd., Chicago 24, Ill., this industrial switch is rated at ½ amp., 110 volts. The switch is provided for panel mounting

General Electric's Limit Switch Is Oilproof for Machine-tool Use



A small oilproof, track-type switch for machine tool and similar applications, has been added to the line of limit switches produced by General Electric Co., Schenectady 5, N. Y. Interchangeable operating heads permit roller-lever, roller-push-rod, push-rod, or plunger operation of the switches.

The switch contains a single-pole, double-throw, snap-action control in a molded oilproof inclosure.

William Nugent Multiple Oiler Includes A 3-pint Reservoir

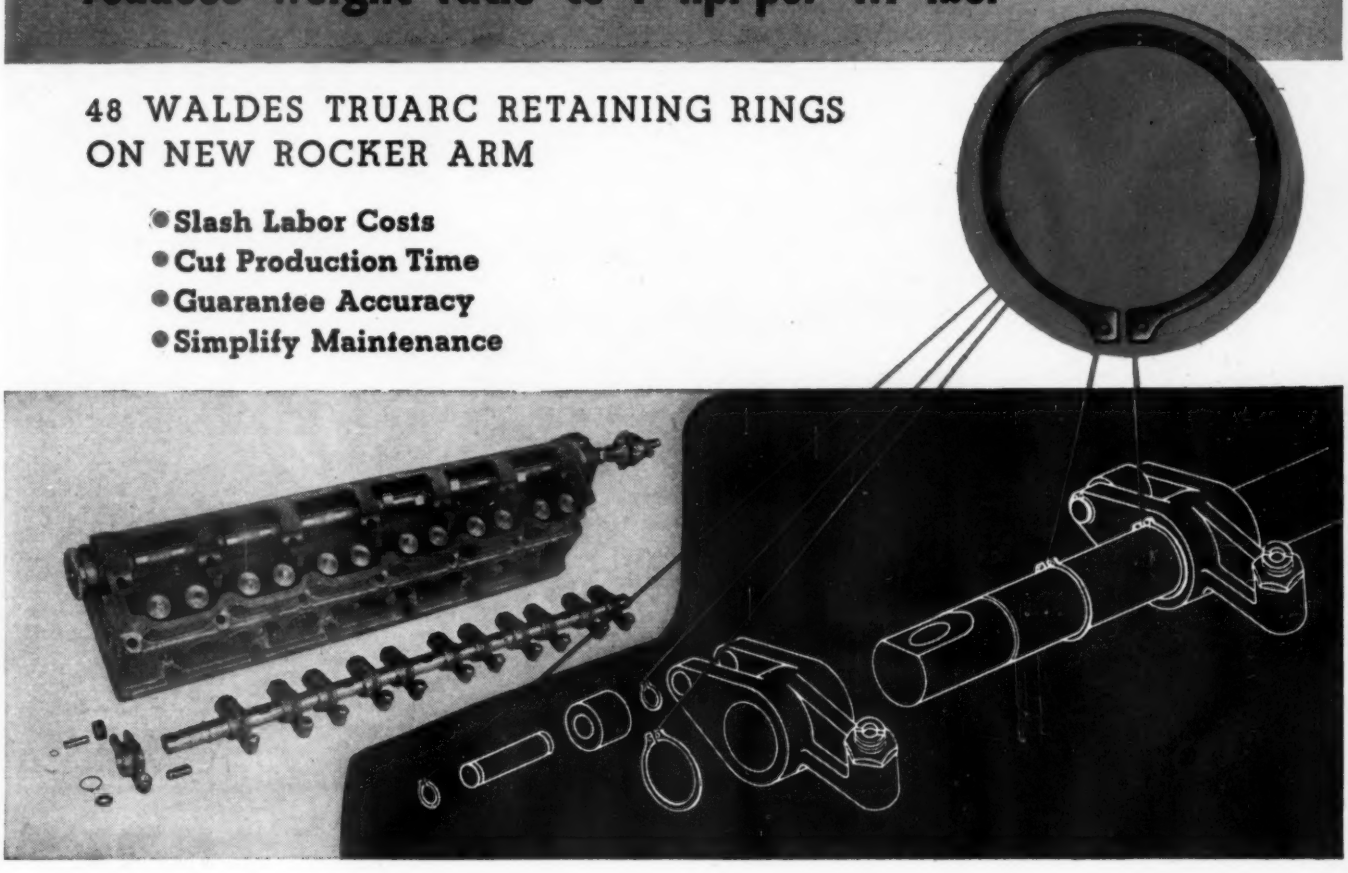
A heavy-duty multiple oiler with a reservoir capacity of three pints is announced by William W. Nugent & Co. Inc., Chicago, Ill. Designed for any machine that requires drop feed or small stream, it is available with a string of sight feed valves in multiples of from 2 to 23 feeds.

The strainer in each sight feed, together with the glass may be removed for cleaning without the use of tools and without stopping the flow of oil. Union outlets on each feed are available in sizes from ⅛ to ⅜ in.

Twin Coach uses Truarc Rings on new bus engine—reduces weight ratio to 1 hp. per 4.7 lbs.

48 WALDES TRUARC RETAINING RINGS ON NEW ROCKER ARM

- **Slash Labor Costs**
- **Cut Production Time**
- **Guarantee Accuracy**
- **Simplify Maintenance**



"WE'VE FOUND TRUARC A NATURAL FOR AUTOMOTIVE APPLICATIONS!" reports Twin Coach Company, of Kent, Ohio. Their new Fageol Twin Coach engine uses a total of 52 Waldes Truarc Retaining Rings—48 on rocker arm, 4 on water pump and oil pump drive—to develop the remarkable efficiency of 1 hp. per 4.7 lbs. (the average pre-war gasoline bus engine produced 1 hp. for each 9 lbs., diesel engine 1 hp. for each 10 lbs.)

Automotive designers are specifying Truarc rings in transmissions, clutches, brakes, steering mechanism, and other vital assemblies. Production and maintenance men find that Truarc cuts costs sharply, is a superior solution to fastening problems because of its never-failing grip, its patented design assuring constant circularity. Send us your drawings; Waldes Truarc engineers will be glad to show how Truarc can help you.

WALDES
TRUARC
TRADE MARK U. S. PAT. OFF. NO. 348,144
RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

12-1

Waldes Kohinoor, Inc., 47-10 Austel Place
Long Island City 1, N. Y.

Please send Catalog No. 4 on Truarc Retaining Rings to:

Name_____

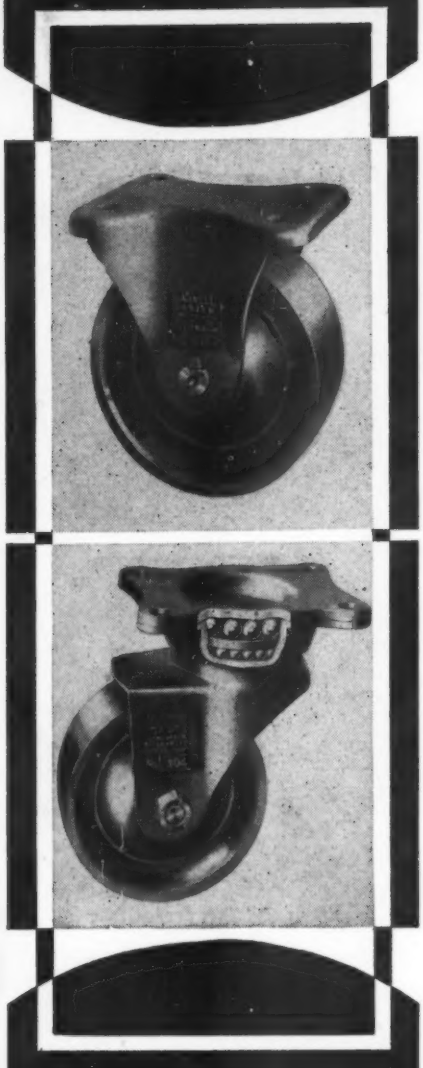
Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Darnell Casters



• Save Money, Floors, Equipment and Time by using DARNELL Casters and Wheels . . Always dependable.

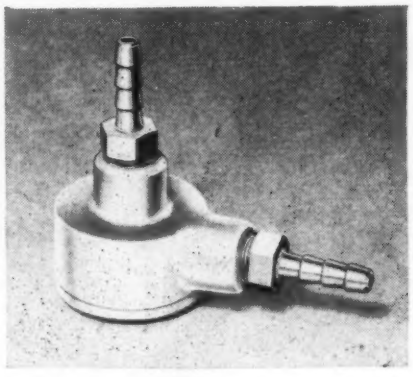
A SAVING AT EVERY TURN

DARNELL CORP. LTD
LONG BEACH 4, CALIFORNIA
60 WALKER ST. NEW YORK 13, N.Y.
36 N. CLINTON, CHICAGO 6, ILL.

Texaco 2-X Gear Lubricant Can be Brushed or Sprayed

A new lubricant which is brushed and sprayed on open gears, Texaco No. 2-X Fluid, is announced by The Texas Co., 135 E. 34th St., New York, N. Y. The lubricant contains a base material which has high adhesiveness, and which is cut back with a non-inflammable solvent. The result is said to be a lubricant which is both efficient and easy to apply.

Mead Specialties Air Valve Has Quick-exhaust Feature



A quick-exhaust valve for pneumatic cylinders is announced by Mead Specialties Co., Dept. E. V. 4, 4114 North Knox Ave., Chicago 41, Ill. The valve acts on the principle of a bellows to expel the air quickly.

The valve opens as soon as the air supply is shut off, speeding the return stroke. It can be attached directly to air cylinders with a ¼-in. pipe nipple, or cut into the air hose adjacent to the cylinder.

Cramer's Synchronous Control Has Choice of 28 Gear Trains

A self-starting synchronous motor for application in the instument and control field, the SX, is announced by R. W. Cramer Co., Centerbrook, Conn. The motor is compact in design, being 2⅜ x 2⅛ x 1½ in. in size. Torque is 30 in. oz. at 1 rpm.

The rotor speed is 240 rpm. at 60 cycles, and power consumption is 2.7 watts. Twenty-eight standard gear trains are available which range from 60 rpm., to 1 rev. in 24 hours.

Air Reduction Brazing Flux Is Used to Braze Aluminum

Elite Aluminum Brazing Flux for brazing 2S, 3S, 53S and 61S aluminum is announced by Air Reduction, 60 E. 42nd St., New York 17, N. Y. The flux is used with Airco No. 26 wire.

RADIAL STRENGTH adds to life of

HY-CO Center Drills

This result of the patented "Tip Clearance" feature of HY-CO helps prevent center drill breakage. The reason is given in booklet "A Winner 4 to 1"; also shows why there is no fatigue point on patented HY-CO Center Drills; how LINE CONTACT abolishes out-of-round work; why spiral groove of HY-CO prevents chip jamming; why Bell-Type drills are unnecessary. Send card today with name and company for "A Winner 4 to 1" to Dept. BB.

HOWARD H. HEINZ, INC.
318 BOULEVARD BUILDING
DETROIT 2, MICHIGAN

PATENT No. 2,403,861

NO MORE Push-Pull-Lift-Lug

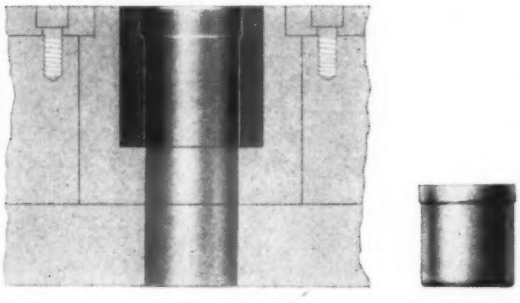
Modern materials-handling methods are rapidly cutting down the physical effort once necessary in manufacturing activity. Cranes and conveyor systems; lift trucks and hoists . . . these and other sweat-savers are reducing costs while production rises.

If you'd like to know more—copies of "Modern Materials-Handling Methods", *American Machinist's* Special Report for June 20th are still available in limited quantities. We'll be happy to fill your order. 15¢ a copy—13¢ in quantities of 50 or more.

AMERICAN MACHINIST
330 West 42nd Street
New York 18, N. Y.

PRODUCTION UPPED FROM 60,000 PIECES TO 700,000

By changing to CARBOLOY* Sheet Metal Dies!



Pieces were drawn from steel .030" thick, using Carboloy Cemented Carbide deep-drawing dies. Although part design and tolerances were critical, a continuous high production average was obtained through use of die ring inserts.

IN DRAWING REFRIGERATOR MUFFLER SHELLS FROM .030" STEEL, production was increased over 11 times with the relatively simple change to Carboloy Cemented Carbide Sheet Metal Dies. And these results are typical of the tremendous production improvements which follow the change to Carboloy Cemented Carbide Dies in *all* Cupping, Blanking, and Drawing operations.

Users regularly report closer tolerances on drawn parts—fewer "rejects"—lower cost per piece—virtually mirror-smooth surface finish (often markedly reducing buffing time)—and big increases in output-per-press.

Put these improvements into *your* operations! Change to Carboloy Cemented Carbide Dies. (Booklet D-120 gives you an idea of the results you'll get. Send for it today—free.)

Carboloy Company, Inc., 11149 E. 8 Mile St., Detroit 32, Mich. Offices in Chicago, Cleveland, Detroit, Houston, Los Angeles, Milwaukee, Newark, Philadelphia, Pittsburgh, Thomaston, Connecticut.

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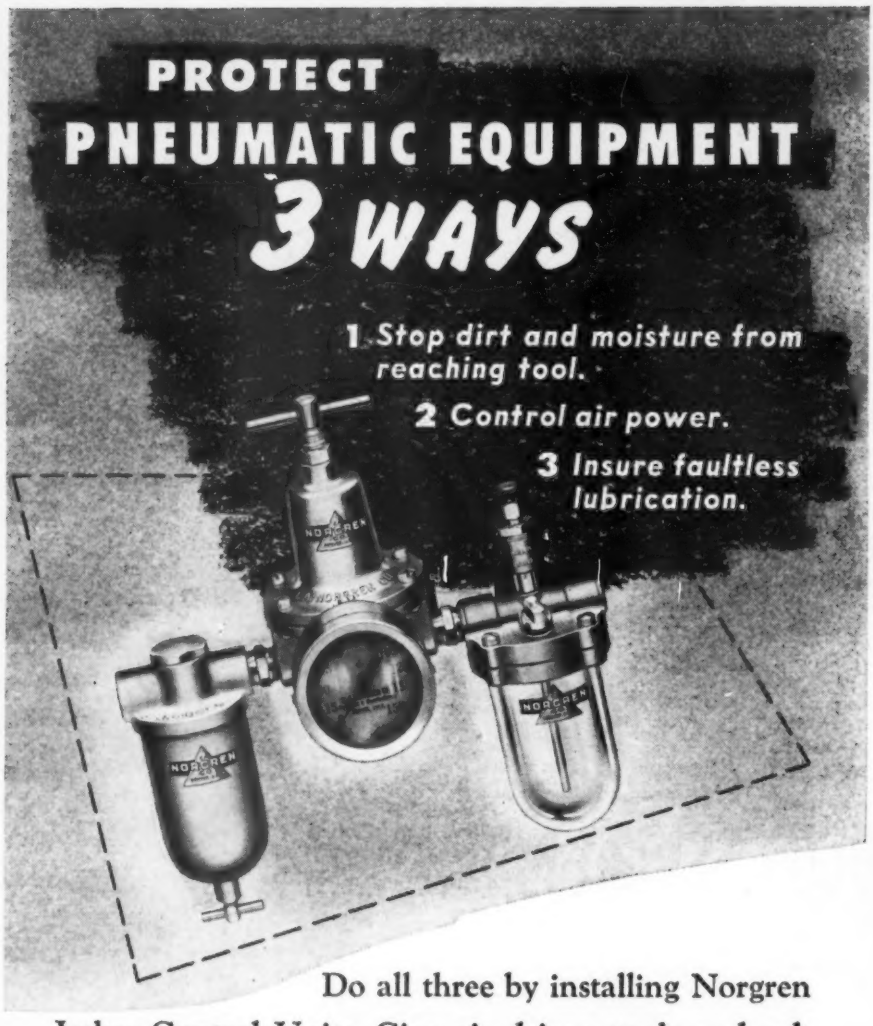

Do all three by installing Norgren Lubro-Control Units. Give air driven tools and cylinders a new lease on life.

Compact unit, less than a foot long. Automatic, works only while the tool runs. Consists of filter, regulator and lubricator. **Filter** stops destructive rust, dirt and pipe scale; corrosive oil emulsion and moisture. **Regulator** transforms uneven air pressure into a smooth, steady stream of power. **Lubricator** oils the air that drives the tool . . . better performance while tool runs; ends rust and corrosion while tool is idle.

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SEEN and HEARD

BY JOHN R. GODFREY

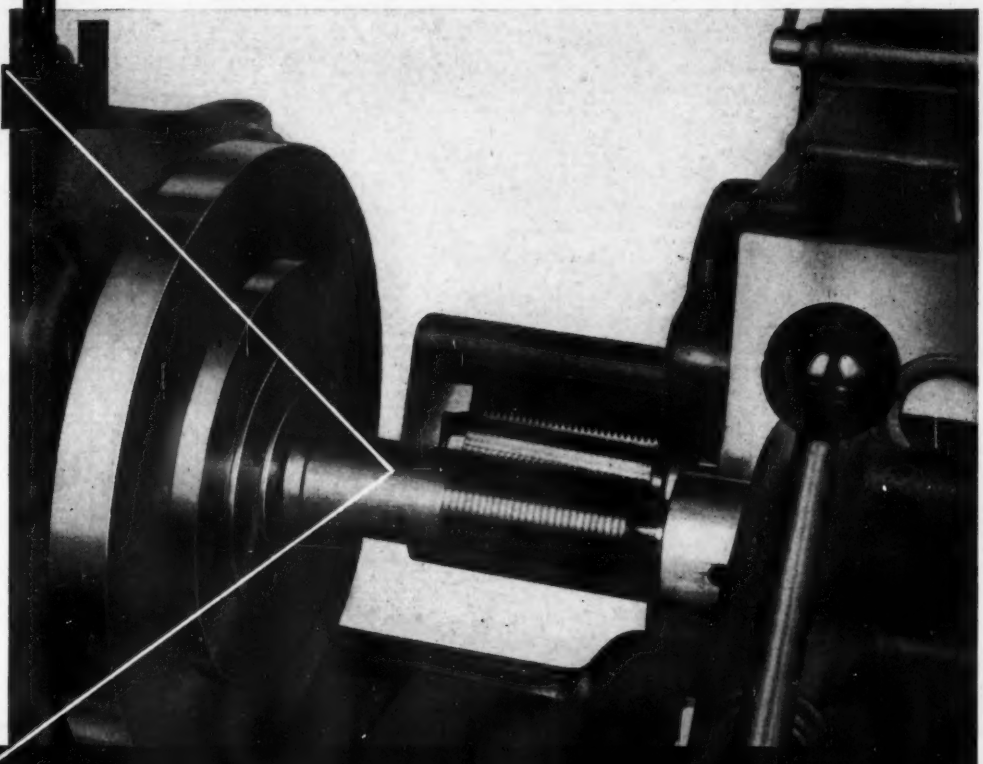
Early Aluminum Engines

In reminiscing about the early attempts to use aluminum and pressed steel in internal-combustion-engine construction, I overlooked my old friend E. W. Roberts of Cincinnati, who built a number of airplane motors with cast aluminum cylinder blocks about 1917. These cylinders had no liners; the pistons and rings bore directly on the aluminum walls, which was none too good in those days. Experiments along this line were also made on the West Coast about this time in the effort to secure lightweight engines for planes. I am under the impression that Marcus Coolidge, of Lo-Swing fame, was interested to some extent in the possibilities of this West Coast engine. Other friends of mine tell me that they flew the Roberts engine in what we called planes in those days. Roberts, incidentally, was present at the tests made of the Maxim steam-driven airplane, in August, 1894.

Haywire Gages

One of my good friends in England writes me about the inexcusable clinging to the different arbitrary wire gages which still inflict themselves on us. It is just as bad in England as here. The electrical engineers took the bull by the horns years ago, when they were young enough not to be bound by precedents set by the older mechanical engineers, threw away the numbered and lettered gages and adopted the "mil," or thousandth of an inch, as the basis for all their wire work. They give all wire sizes in "mils" instead of by numbers; no one has to look up a wire table, nor has any alibi for using the wrong wires. My first contact with Oberlin Smith, then head of the Ferracute Machine Company, was because of a letter I wrote to the *American Machinist* suggesting the use of thousandths instead of numbers and letters for all wire and sheet gages. It was not a new nor particularly brilliant idea, even then, but we still keep on inviting mistakes and getting wrong sizes because we cling to gages of different kinds. I can think of no better project for the standardization committees of the *A S M E* than to show the bad points of our present system and advocate the adoption of the system which the electrical engineers have used so long.

ONE REVOLUTION IS ENOUGH



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In these days of rising costs, Hanson-Whitney is leading the way to more economical thread production . . . to simplified set-up and operation . . . with the very latest thread milling equipment. Internal or external threads; right or left hand threads; straight or tapered threads are produced automatically in one revolution with a multiple thread milling cutter. That means more volume in a given time . . . less time on a given job. Whether you handle small lot or mass production jobs, Hanson-Whitney engineers can show you how to realize direct savings from lower equipment costs, from reduced maintenance, and from lower labor costs. For further information, write: The Hanson-Whitney Machine Company, Hartford, Conn.

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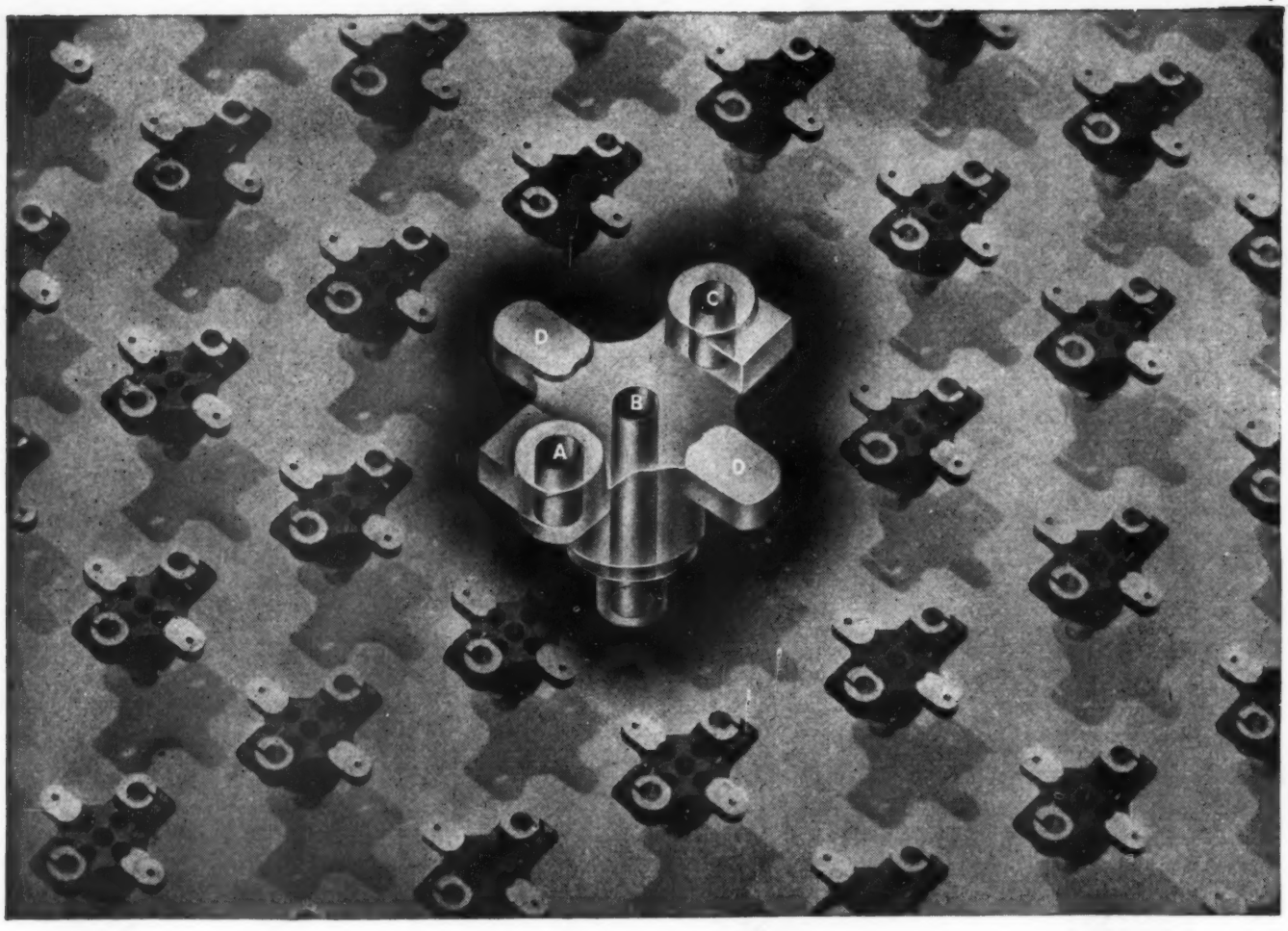
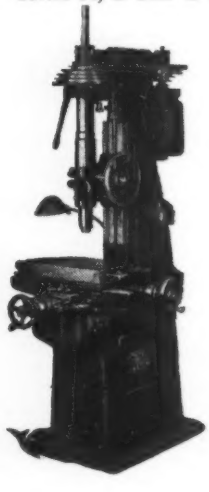


How to use the *Moore Jig Borer* as a Production Machine

Three holes located and sized, two pads milled—in a single set-up; 5,000 aluminum parts—6 minutes each. Are you limiting the capacity of your jig borer by using it only on toolroom work? You needn't...if it's a Moore Jig Borer.

For this versatile machine not only adds toolroom accuracy to your production jobs but often outperforms special-purpose machines. Here's proof on a run of 5,000 aluminum parts:

Holes A, B and C were located to a tolerance of .0005", sized to + .0005",—.0000"...had to be parallel to .001" checked on plugs 1" long...two pads D milled to ±.001".



In order to hold these pads in close relation to the holes, the job was done in a single set-up.

A drill jig couldn't handle such close tolerances; reamers and bushings would wear. Since aluminum is not free-machining, a good finish would be difficult to obtain with reamers.

The only answer was single-point boring. After the holes were roughed out with a jig costing $75, the Moore Jig Borer machined them to exact location and size. The entire operation, including the machining of the two pads, required only six minutes each and reduced appreciably all previous costs.

Such speed and accuracy are the result of the Moore Jig Borer's sensitive spindle which provides speeds to 2,600 RPM, and quick-setting lead screws. The latter, ground to an accuracy of .0002" in 16", enables you to spot, drill, bore and ream holes in one set up, with minimum tool changes.

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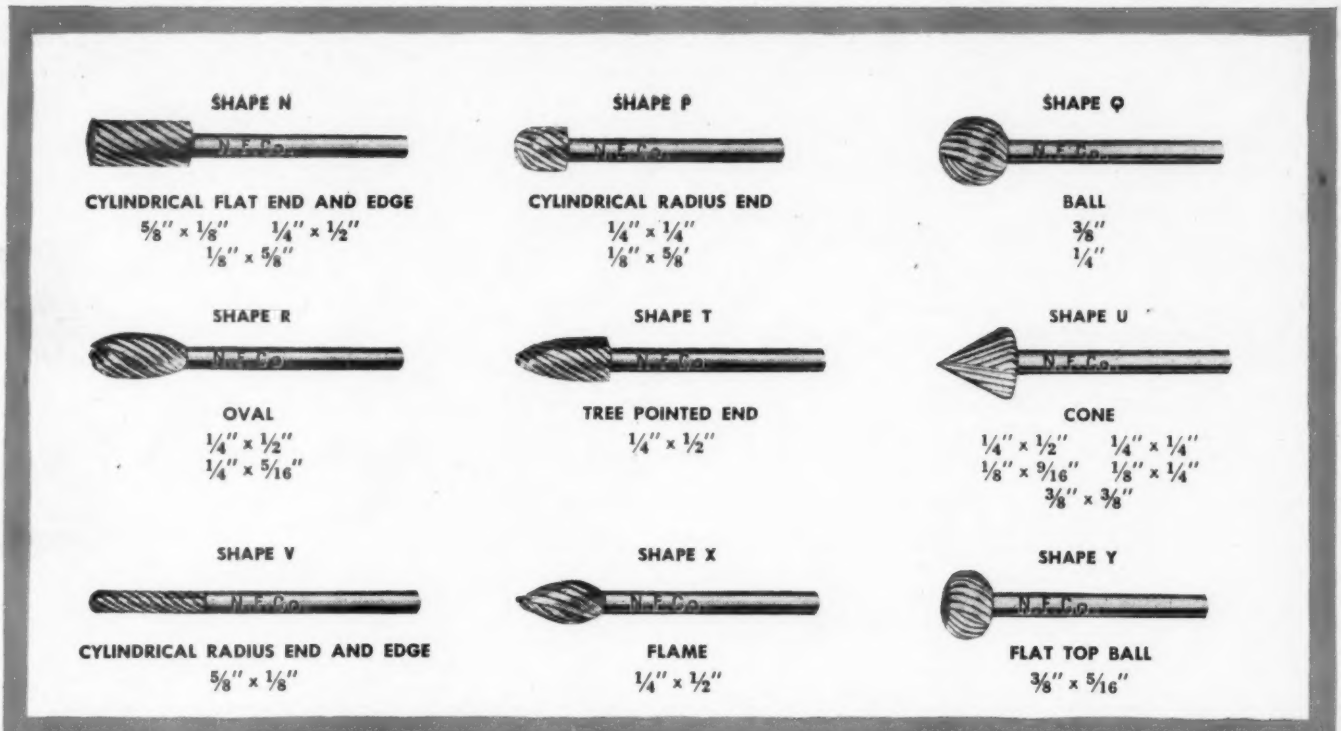

1/8"-SHANK ROTARY FILES AND BURS

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HAND Cut Rotary Files and Ground-from-Solid Burs *with 1/8" shanks* are now available under the name of the world's foremost file manufacturer—NICHOLSON. These small, power-driven hand tools answer the widespread need of industrial craftsmen for *quality* burs in sizes designed for relatively delicate filing operations.

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Nine standard styles or shapes are offered in either Hand Cut (Rotary Files) or Ground-from-Solid (Burs). Stock diameters range in sizes from 1/8" to 5/8". Shanks are code-stamped for easy identification.

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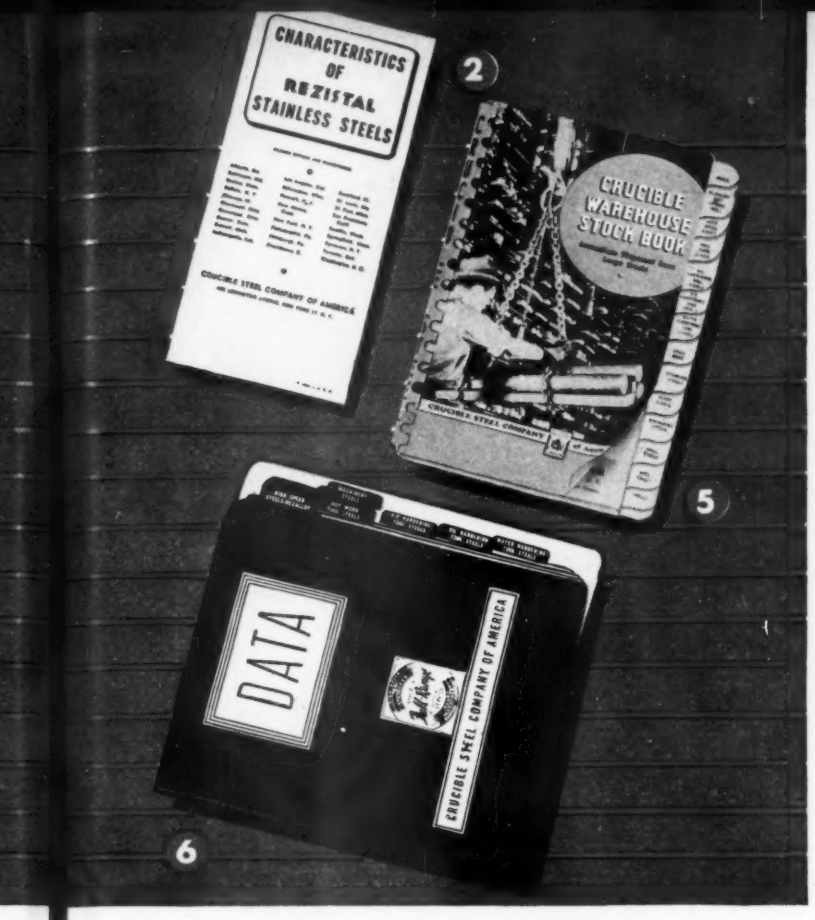

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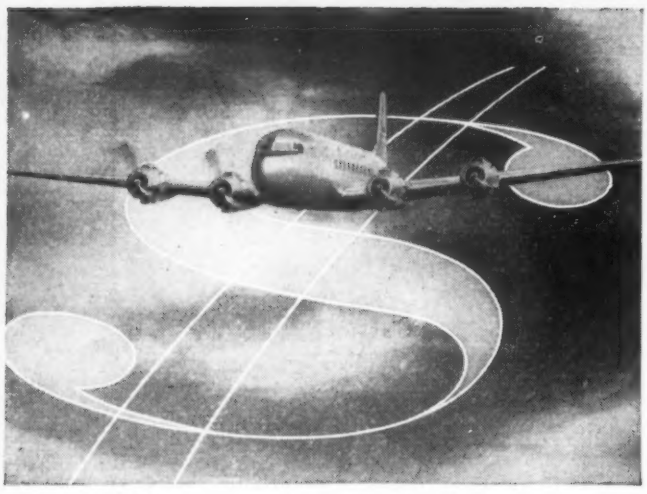

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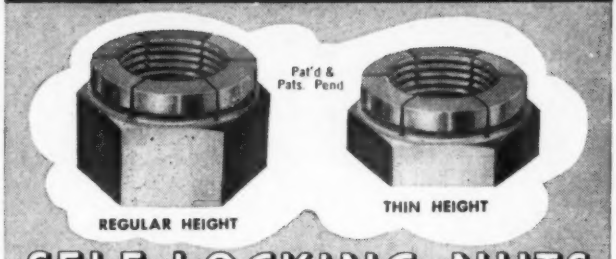

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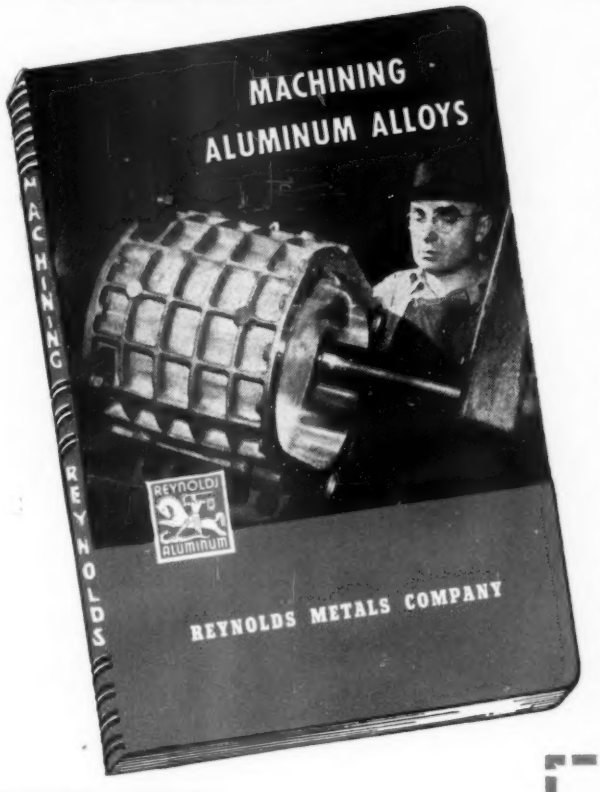
NEW! ...a process manual on "MACHINING ALUMINUM ALLOYS"

SPECIFIC RECOMMENDATIONS FOR MACHINING OPERATIONS IN COMPACT CHART FORM



There are a lot of practical, up-to-date facts about machining aluminum alloys packed into this new 124-page handbook compiled by the technical staff of Reynolds Metals Co.

For instance, eight double-page charts give specific usable data on tooling, speeds and feeds for eight important types of machining operations: Turning, milling, shaping and planing, drilling, reaming, tapping, filing and sawing.

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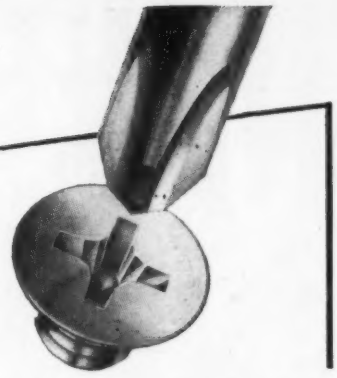
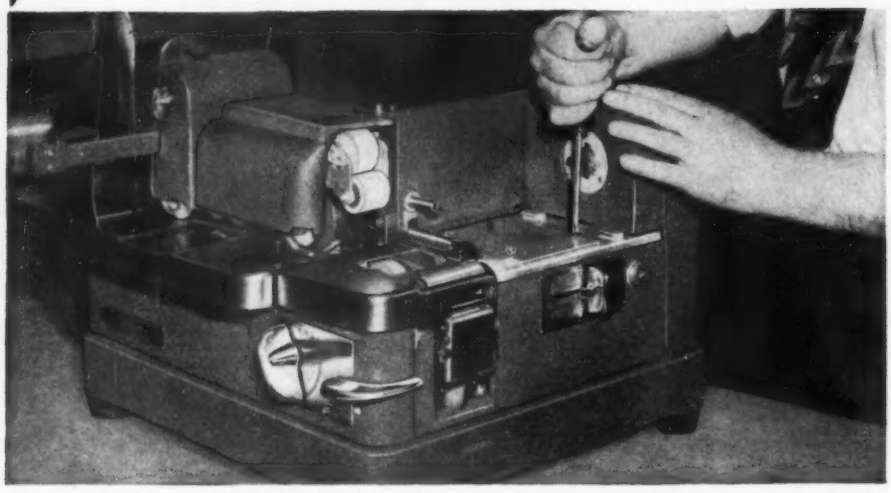
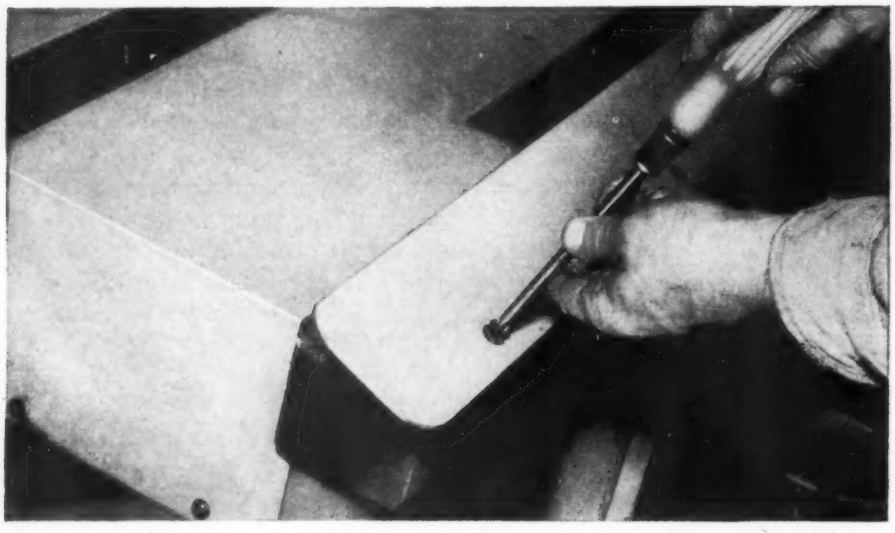
PHILLIPS SCREWS SPOT THE *Profit-planned* ASSEMBLIES





Assembling the satin-finished, nickel-plated mail feed plate on a Pitney-Bowes Postage Meter Machine. As their Production Engineer, Mr. Diller, said, "A burr on a screw head could catch the mail and keep it from feeding through the machine properly. If bad enough, it could even tear or scratch the mail. Since we changed over to Phillips Recessed Head Screws, about five years ago, I don't believe we've had a single case of a burr on a screw head or of damage to the plate from driver slippage."



Crossed threads would waste time on assembly jobs like this, attaching guards on a Norton Grinding Machine. The "engineering fit" of the Phillips Screw and the Phillips Driver makes it easy for assemblers to find the thread and start the screw without delay.

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Phillips driver automatically centers in the recess – fits snugly. Fumbling, wobbly starts are eliminated. New assembly workers learn faster. Spiral and power driving can often replace hand driving.

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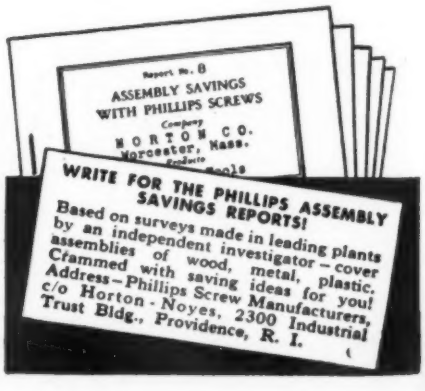
Put your product in the ever-increasing "profit-planned" group . . . specify Phillips Recessed Head Screws!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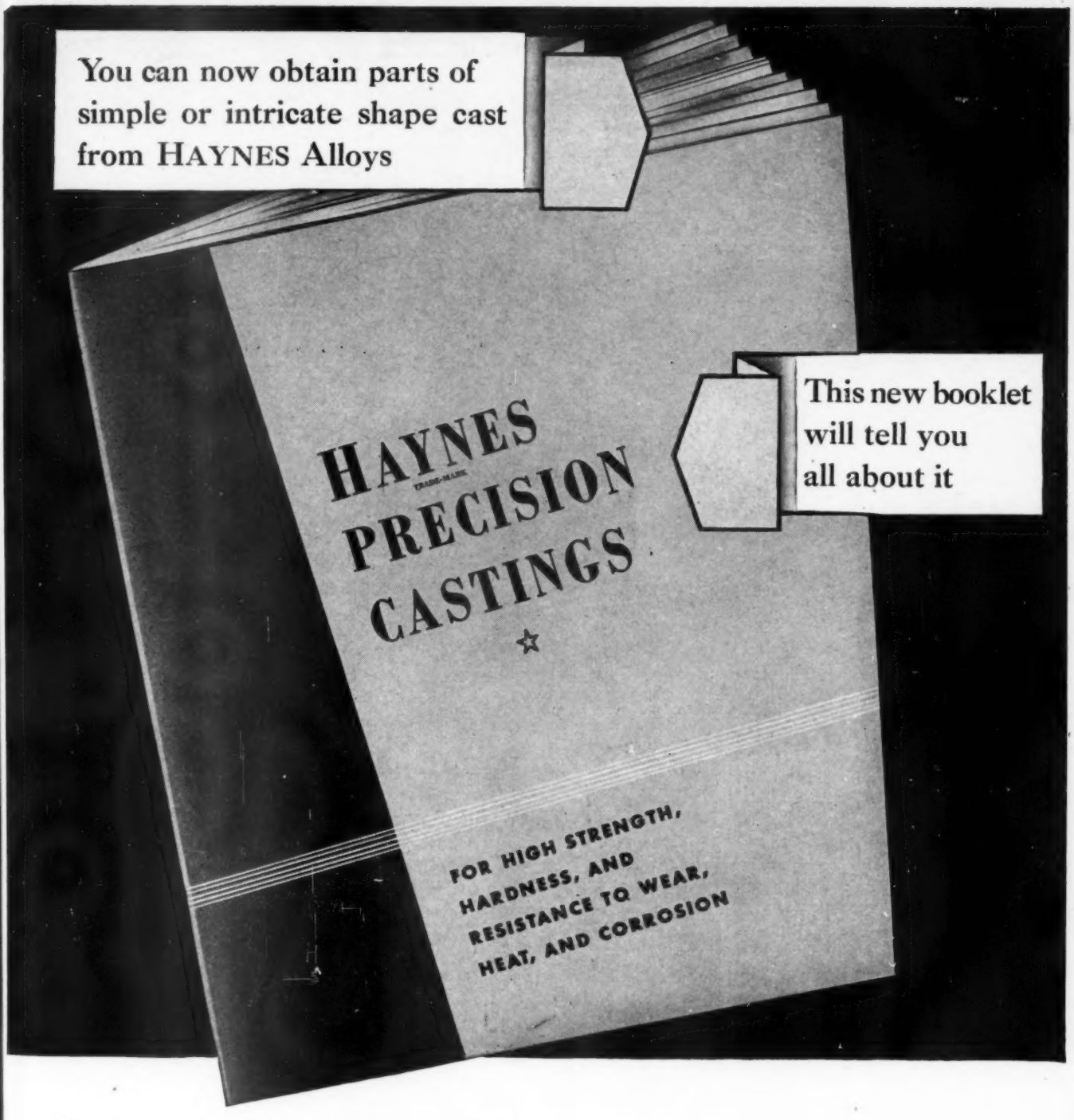

This new booklet will tell you all about it

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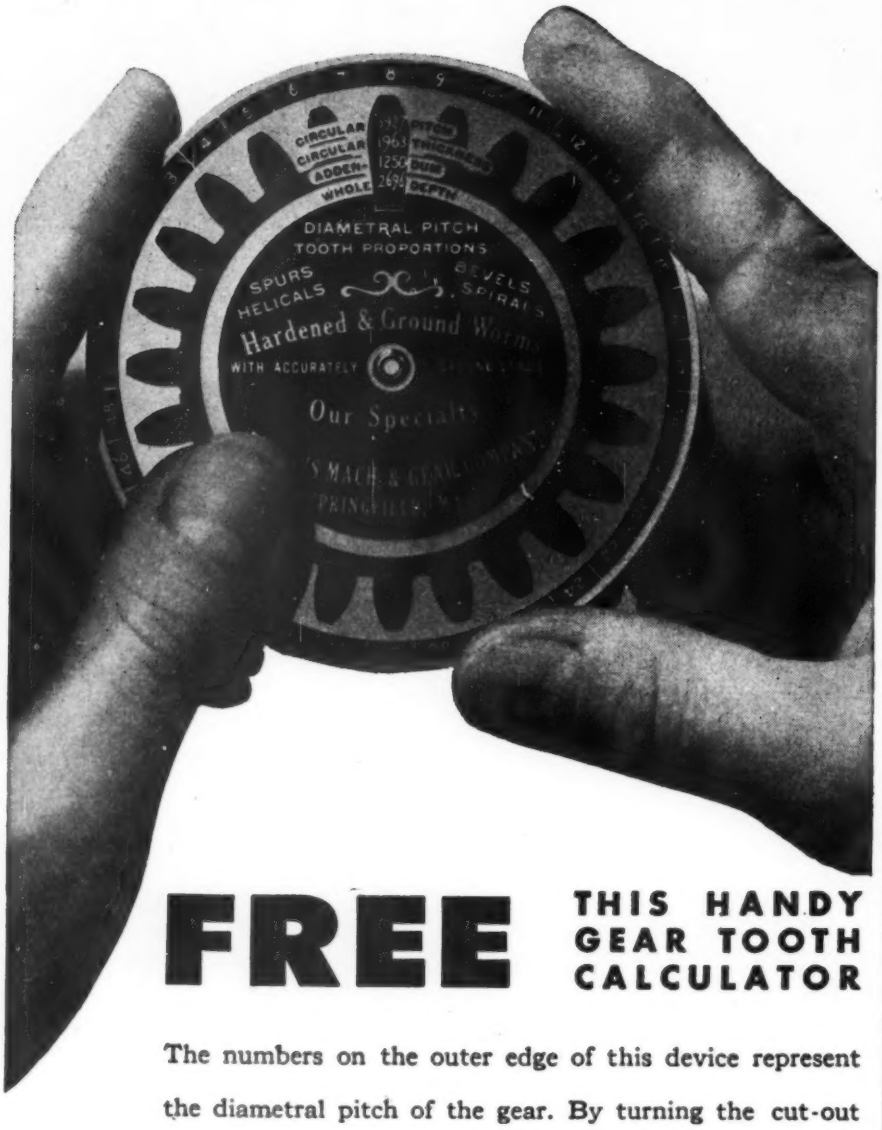

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Bronze Bearings do not rust or deteriorate in storage. Bunting Cast Bronze Bearings can be withdrawn from stock and installed with the assurance that quality is unimpaired by lapse of time. Our engineers are qualified to assist in your bearing design. The Bunting Brass and Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.

Bunting

54

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

A MILLION MAGIC FINGERS clean up the plates

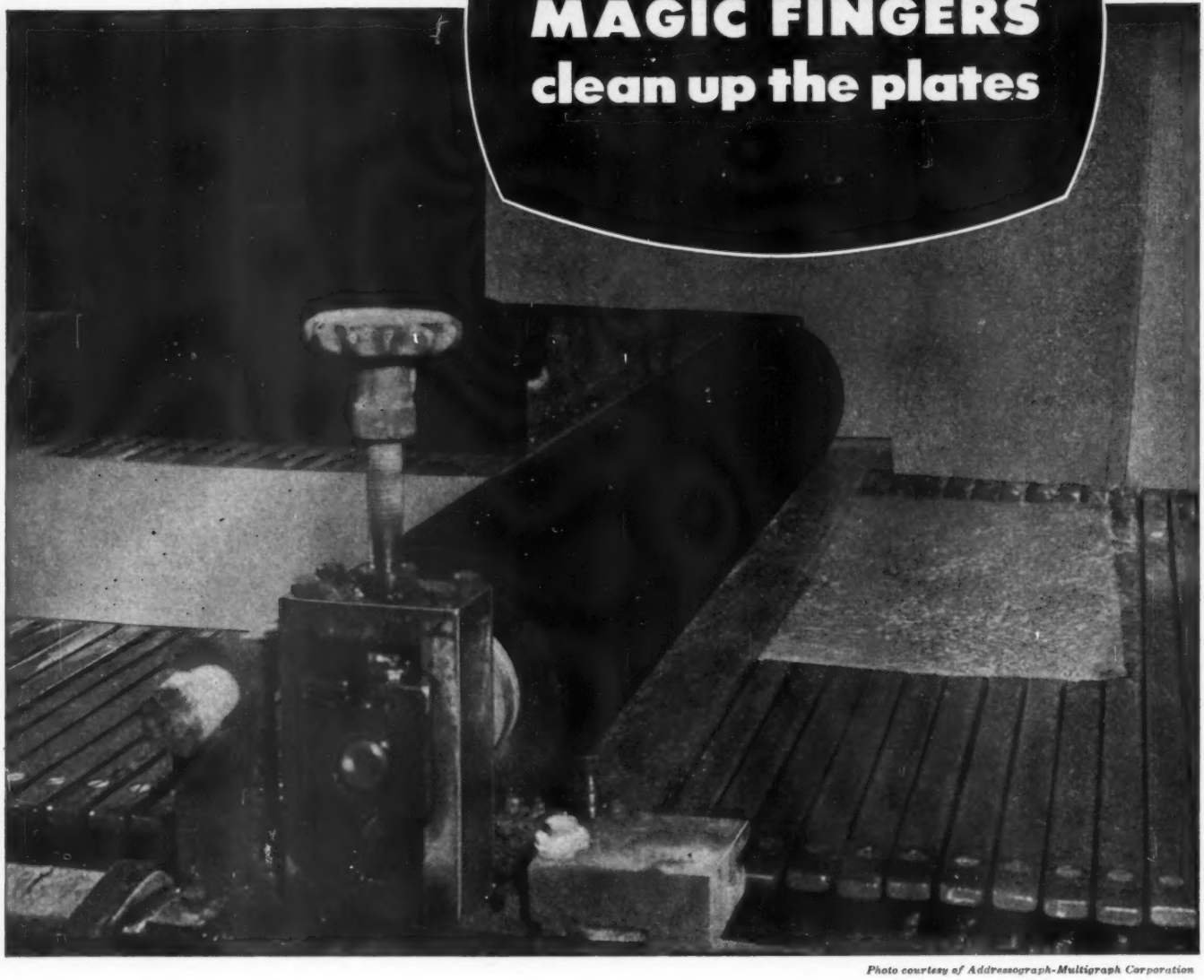


Photo courtesy of Addressograph-Multigraph Corporation

THE zinc sheets which ultimately become Multilith plates require a delicate scrubbing (and quick drying!) as they pass through the manufacturing stage at Addressograph-Multigraph Corporation.

Formerly this was a slow, costly, hand-sponging job. Today it is fast, accurate and cheap—thanks to a unique washing machine developed by Addressograph-Multigraph.

This machine embodies an automatic gravity water wash, speeds the sheets past a 36" *Osborn Rotary Spiral Brush,* dries them in a gas drying cabinet—all in a fraction of a minute!

Unusual process?—of course! But there are thousands of unusual processes in almost every industry (as well as millions of usual ones!) where Osborn brushes can help speed up manufacture, cut costs—and produce a better, more uniform and more saleable product.

Why not let an Osborn engineer bring you up to date on the latest Osborn brushing techniques, and show how they can be applied to your business? Just ask us to have him call, without obligation to you, of course.

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue *Cleveland, Ohio*

Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

FOR EVERY APPLICATION

– every load

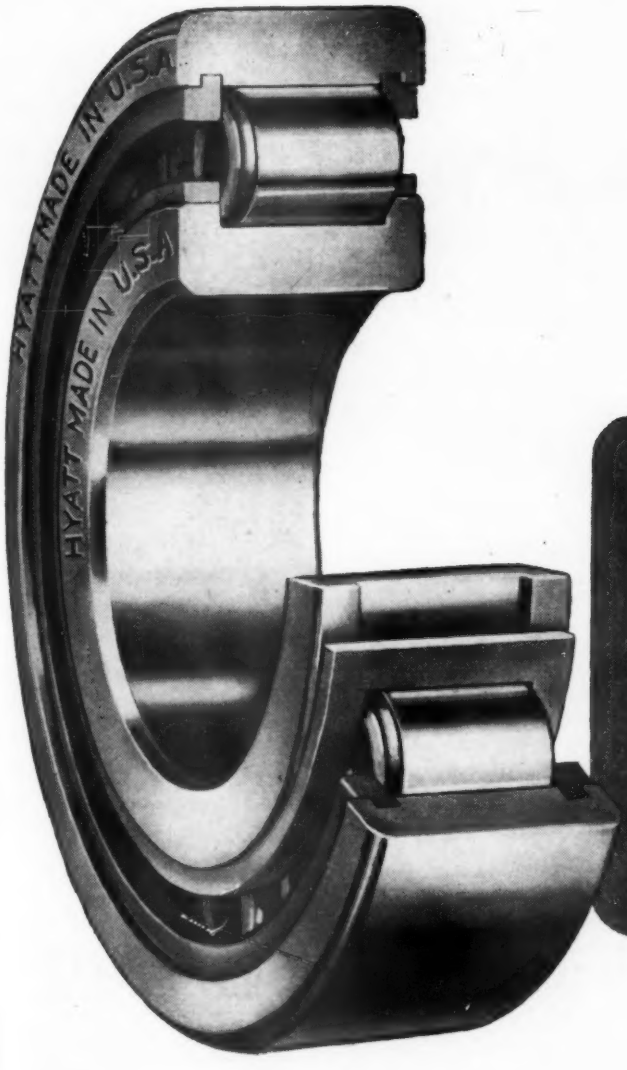
– every speed

– every position

All kinds of mechanical equipment, automotive, industrial, agricultural have one thing in common — bearings by Hyatt.

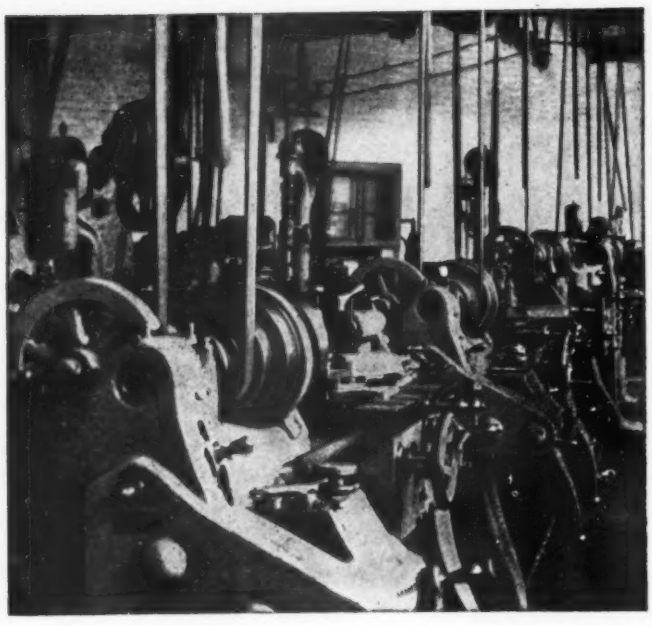
And there are thousands of other examples where machine design engineers and ultimate users alike are in accord — approving Hyatt Roller Bearings.

The large number of types of Hyatts available means there is a Hyatt Roller Bearing for every application. Consult us on your bearing problems. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.



HYATT
ROLLER BEARINGS

Your Belts Like Thousands of Others Have Had FIVE HARD YEARS



They may need a rest. Probably some should be replaced. Certainly they deserve inspection and care. *Now* is the time to replace worn belts with TANNATE Leather Belting for maximum output on any type of drive . . . vertical, floor, wall or ceiling—with large or small motor. On any machine, a TANNATE-belted drive will *maintain consistently high production*, without slip and stretch, without stoppage or breakdowns.

TANNATE'S powerful grip assures maximum power transmission at top speeds, you get uniform work with less spoilage. And its exceptional strength and stamina give a long service life with practically no maintenance.

Many mills have reduced costs by consulting Rhoads Engineering Service. The benefit of our long experience is available in the solution of your cost and production problems. Ask for "Better Service Belt Hints."

STEP UP PRODUCTION with

RHOADS *Tannate* WATERSHED LEATHER BELTING

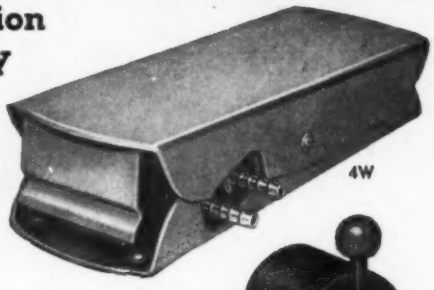
ESTABLISHED 1702

J. E. RHOADS & SONS

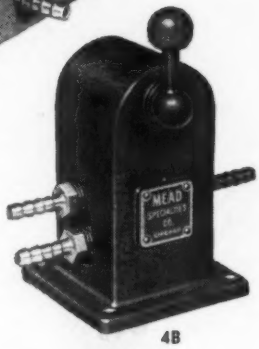
35 North Sixth Street, Philadelphia 6, Pa.

NEW YORK • CHICAGO • ATLANTA

READY.. *the New* MEAD Combination 3 or 4 Way AIR VALVE



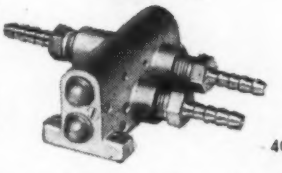
This new, ingenious MEAD VALVE is almost universal in its uses yet is so simply constructed it gives long, troublefree service. No sliding closures . . . 1/16" movement operates from full open to full closed helping speed of action, minimizing operational fatigue.



4B

4B BENCH VALVE . . . for use on machine table or bench. Functions as a 4-way valve . . . two 3-way valves . . . one 3-way valve . . . and as a 3-way valve and a blower!

4W FOOT CONTROL . . . pedal works valve either as 3-or-4-way. Adjustable pedal stop provides quick change from 3-way to 4-way. Same combination of functions made by rocking pedal as by moving lever of bench valve.


4C

4C FOR CAM OPERATION . . . can be mounted on drill press, etc., for automatic control of air cylinder by suitable cam.

WRITE for new Air Power Catalog describing Mead's Air Vises, Clamps, Presses, Workfeeders, Controls, etc. Just off the press!

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Centrifugal pumps for Dependable Operation where coolant contains abrasives

Brown & Sharpe Centrifugal Pumps have hydraulically balanced impellers, designed to handle coolants containing abrasives, without excessive wear within housing. The grease sealed ball bearings require no lubrication. Motors totally enclosed. Numerous styles for both horizontal and vertical installation requirements. Write for catalog of complete line of geared, vane and centrifugal pumps. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

We urge buying through the distributor

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1500 P.S.I.

OPERATING PRESSURE

with the new, improved

GEROTOR "QH" HYDRAULIC PUMP

Gerotor announces the basically new "QH" hydraulic pump... offering decidedly bigger advantages, better design. Delivers pressures up to 1500 p. s. i. intermittently . . . 1200 p. s. i. continuously. Four sizes . . . with capacities of 3, 5, 8 and 12 g. p. m. . . . available now! Write for folder giving all the facts you need.

GEROTOR

GEROTOR MAY CORPORATION
BALTIMORE 3, MARYLAND

LET LESS METAL MAKE MORE MONEY

It's expensive to hold a mechanism in place with unnecessarily big shoulders or collars,—or to temporize with small cotter pins, etc. Let us show you how spring steel retaining rings can do a thoroughly efficient job for you.

More and more retaining rings are being used in these days of necessary economy. Every ounce of metal and every cent of cost is more important today than ever before.

It is needless waste in most instances to turn your shoulders by cutting down larger shafts, when you can groove a smaller shaft and apply a spring steel retaining ring. You'll get excellent results at unbelievable savings.

Every shoulder on your machines or on your metal products should be examined to see whether or not smart engineering could take advantage of these modern artificial shoulders on shafts or in housings.

Write today for our descriptive folder on Retaining Rings.

THE NATIONAL LOCK WASHER COMPANY
Newark, N.J., Milwaukee, Wisc., U.S.A.

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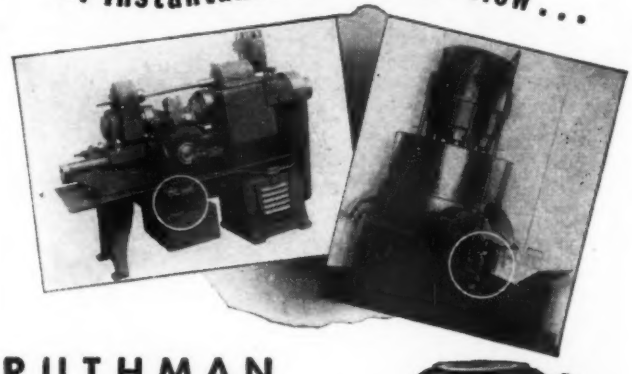
Rano Bronze Corp.
PRECISION BRONZE BEARINGS
Clearfield and Witte Streets
Philadelphia 34, Penna.
We welcome the opportunity to quote you on your prints; production runs our specialty.

for instantaneous coolant flow . . .

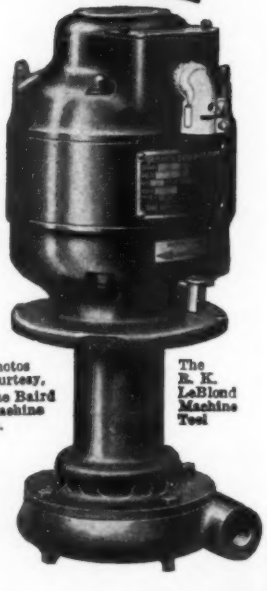


RUTHMAN GUSHER COOLANT PUMPS

Machine tool manufacturers realize the importance of "split second" coolant control, from a trickle to full volume. That's why so many of them install Ruthman Gusher Coolant Pumps as standard equipment.

Left above is a 1/10 H.P. MODEL 1-P3 GUSHER COOLANT PUMP installed on a LEBLOND #1 CRANKSHAFT LATHE. To the right is a ½ H.P. MODEL H. L. 7420 RUTHMAN GUSHER PUMP installed on a "BAIRD 5" FOUR SPINDLE VERTICAL CONTINUOUS LATHE.

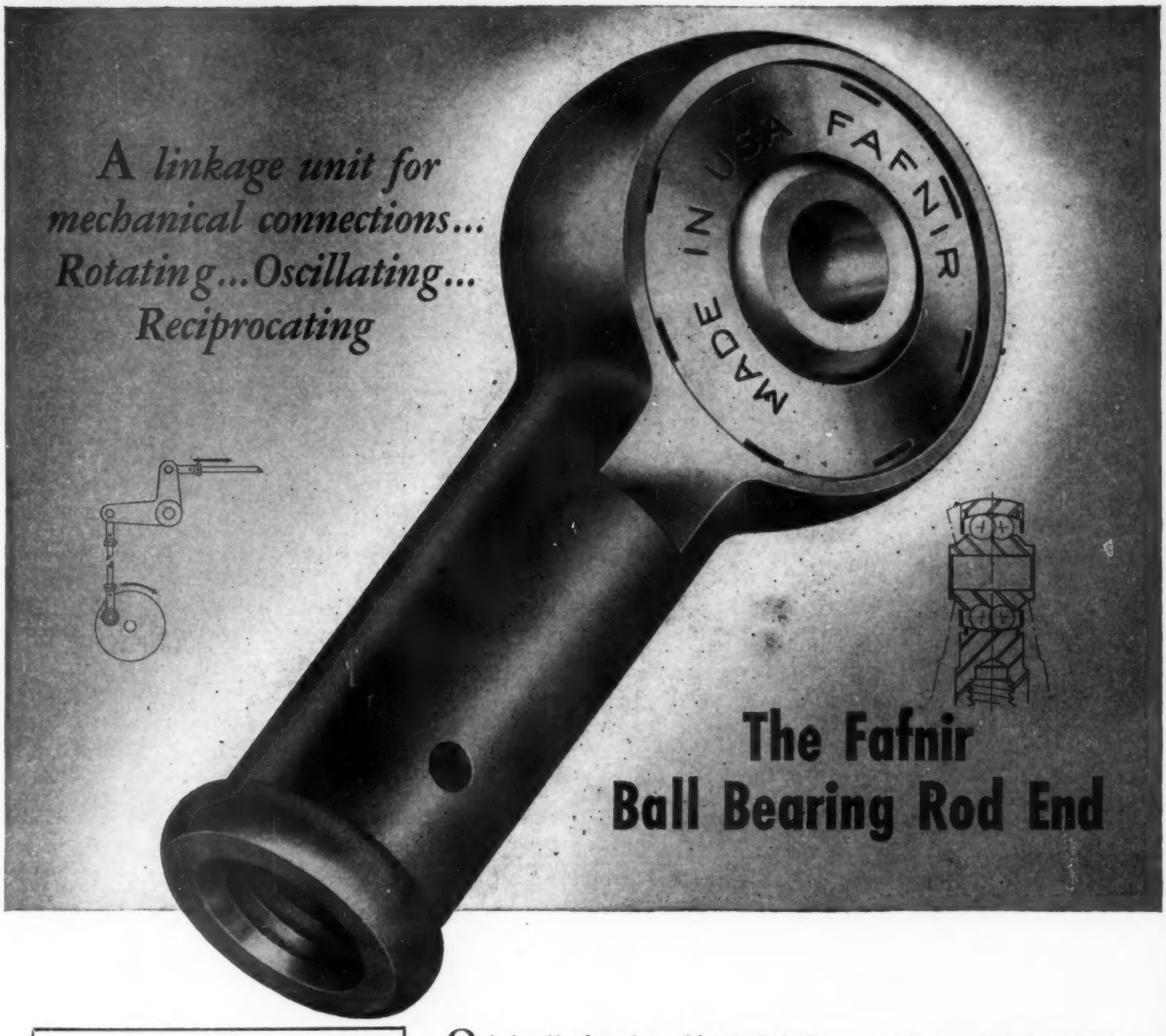
Write for Catalog 10A



Photos courtesy, The Baird Machine Co. The R. K. LeBlond Machine Tool

THE RUTHMAN MACHINERY CO.

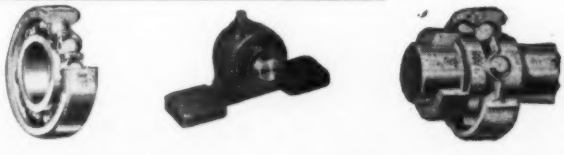
1809 Reading Road, Cincinnati, Ohio


A linkage unit for mechanical connections... Rotating...Oscillating... Reciprocating
MADE IN USA FAFNIR
The Fafnir Ball Bearing Rod End

FEATURES

self-aligning
sealed or shielded—
to keep out dirt, keep in lubricant
friction free
easily installed and removed
cadmium plated
economical
5 bore sizes
3 types of shanks—
male threaded
female threaded
hollow

Originally developed by Fafnir for smooth, trouble-free flight and engine controls in airplanes, this compact, self-contained, pre-lubricated, lightweight ball bearing unit has been utilized by manufacturers of such diverse products as power lawn mowers, oscillating headlights and engine-in-the-rear busses. Your own experience and imagination will suggest profitable applications to *your* machines. Fafnir engineering services, at our plant and out in the field, are available to you in adapting this and other Fafnir-developed ball bearing units to your product to gain important competitive advantages. We suggest either sending us prints of your machine or writing for data sheets on Fafnir Ball Bearing Rod Ends. The Fafnir Bearing Company, New Britain, Connecticut.



FAFNIR BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

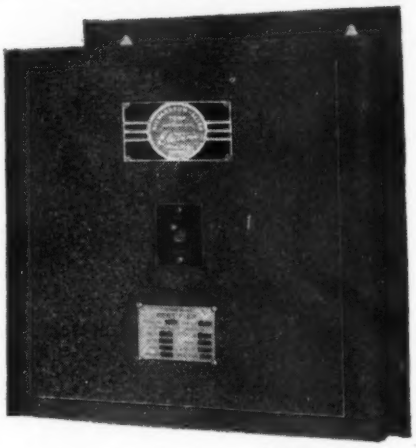
UNITED STATES STEEL SUPPLY COMPANY
USS
STEELS
SERVICE
Our promise to you for 1947
As the Holiday Season approaches, we join with all industry in a fervent hope that conditions of steel supply will improve. Regardless of what the new year may bring forth, we are planning further improvements in our service to you.
It is our hope that the day is not too far distant when our stocks of steel will be large enough to enable you to get what you want, when you want it. In the meantime, we are improving our facilities in every way we can. Already two new warehouses are under construction in St. Louis and Cleveland and others will soon be enlarged and modernized. We intend that our name shall become more than ever the "Symbol of Service to Steel Users."
We wish you happiness during the Holiday Season and success throughout the New Year.
UNITED STATES STEEL SUPPLY COMPANY
Chicago Boston Milwaukee Pittsburgh Twin City
Baltimore Cleveland Newark St. Louis (St. Paul)
UNITED STATES STEEL

The unusual detergency of ECONOMY LUBRICANT 1888 keeps grinding wheels open and free cutting—thereby permitting the use of finer wheels where desired to obtain better finish—less wheel dressing is required—production is increased.

For Grinding and Cutting—Economy 1888

THE WHITE & BAGLEY COMPANY
WORCESTER 8, MASS., U.S.A.
Original Producers of Grinding Lubricant

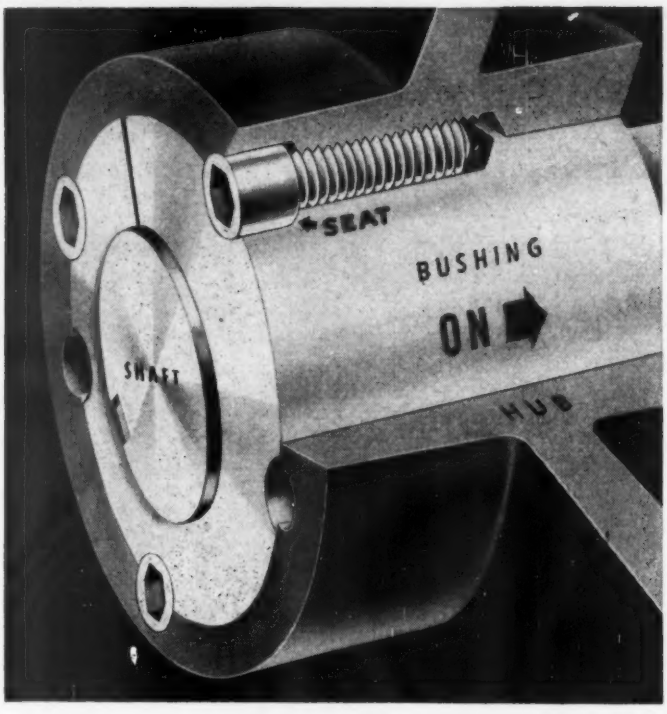
R-A Industrial Rectifiers



Full wave selenium rectification with long life, rugged construction, and free from the effects of shocks Instantaneous operation. No warm-up period required. Wall mounting.

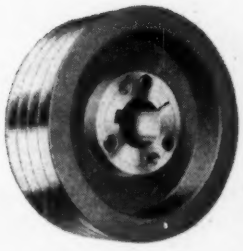
Model	Amps	Volts	Power Source
B-402A	1.5	115	115 Volts A.C.
B-403A	3.0	115	Single Phase
B-404A	5.0	115	50-60 Cycles
B-405A	10.0	115	For All Models

220 and 440 Volts D.C. High Voltage Rectifiers suplied on special order.
WRITE TODAY FOR THE R-A WAY
Rectifier Division
RICHARDSON-ALLEN CORPORATION
15 WEST 20th STREET NEW YORK 11, N. Y.



EASY ON!

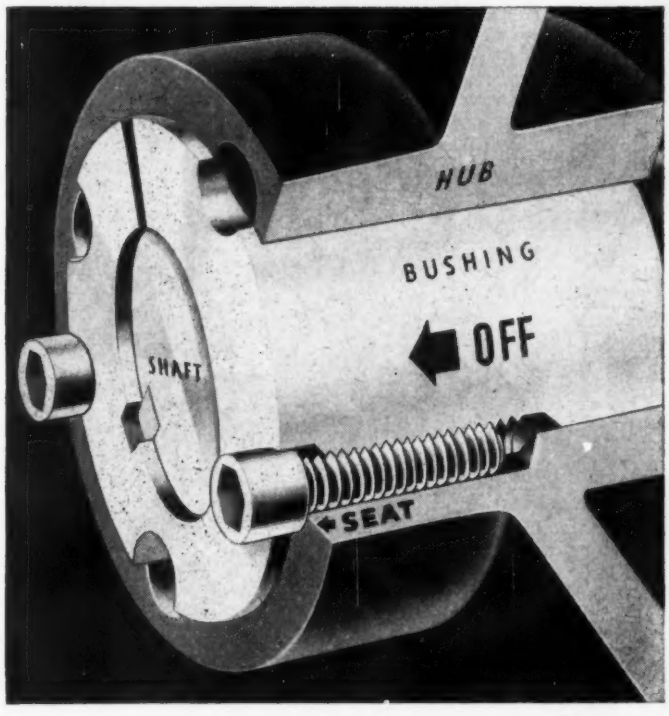
Note that only the HUB is threaded. Screw-head seats itself against offset in bushing. As the screw is turned, the sheave is drawn up—wedged—with a firmness equivalent to a shrunk-on fit, whether the shaft is standard or normally undersize.



NEW TAPER-LOCK BRAND SHEAVE

EASY OFF!

Note that here only the BUSHING is threaded. Screw-head seats itself against face of hub. As the screw is turned, the wedge is disengaged. Due to its steep taper, the bushing disengages with less effort than in any other sheave. It's easy on—and easy off!



Slip it on, line it up and tighten *while sighting*. No flange. No collar. No protruding parts. Easy on—Easy off—and holds fast! The new Dodge Taper-lock brand sheave breaks all speed records in mounting and demounting. A complete range of sizes, from Dual Duty to C and D. For details call the Dodge Transmissioneer, your local Dodge distributor. Look for his name under "Power Transmission Equipment" in the classified phone directory.

DODGE MANUFACTURING CORP., MISHAWAKA, INDIANA

DODGE
MISHAWAKA

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THE SYMBOL THAT CAME TO LIFE

The man who walks into your factory wearing this symbol is the living embodiment of a service which gives you the correct answer to problems in efficient mechanical transmission of power. He is the Dodge Transmissioneer.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

MAXITORQ FLOATING DISC

NO TOOLS *needed* FOR *Installation* FOR *Adjustment* FOR *Take-Apart*

Floating Disc Clutch

No Heating in Neutral

...When you select the MAXITORQ

If you are in any way dissatisfied with your present clutch transmission . . . either in installation, dependability of action, long life, or over-all costs . . . we suggest a prompt investigation of the Maxitorq.

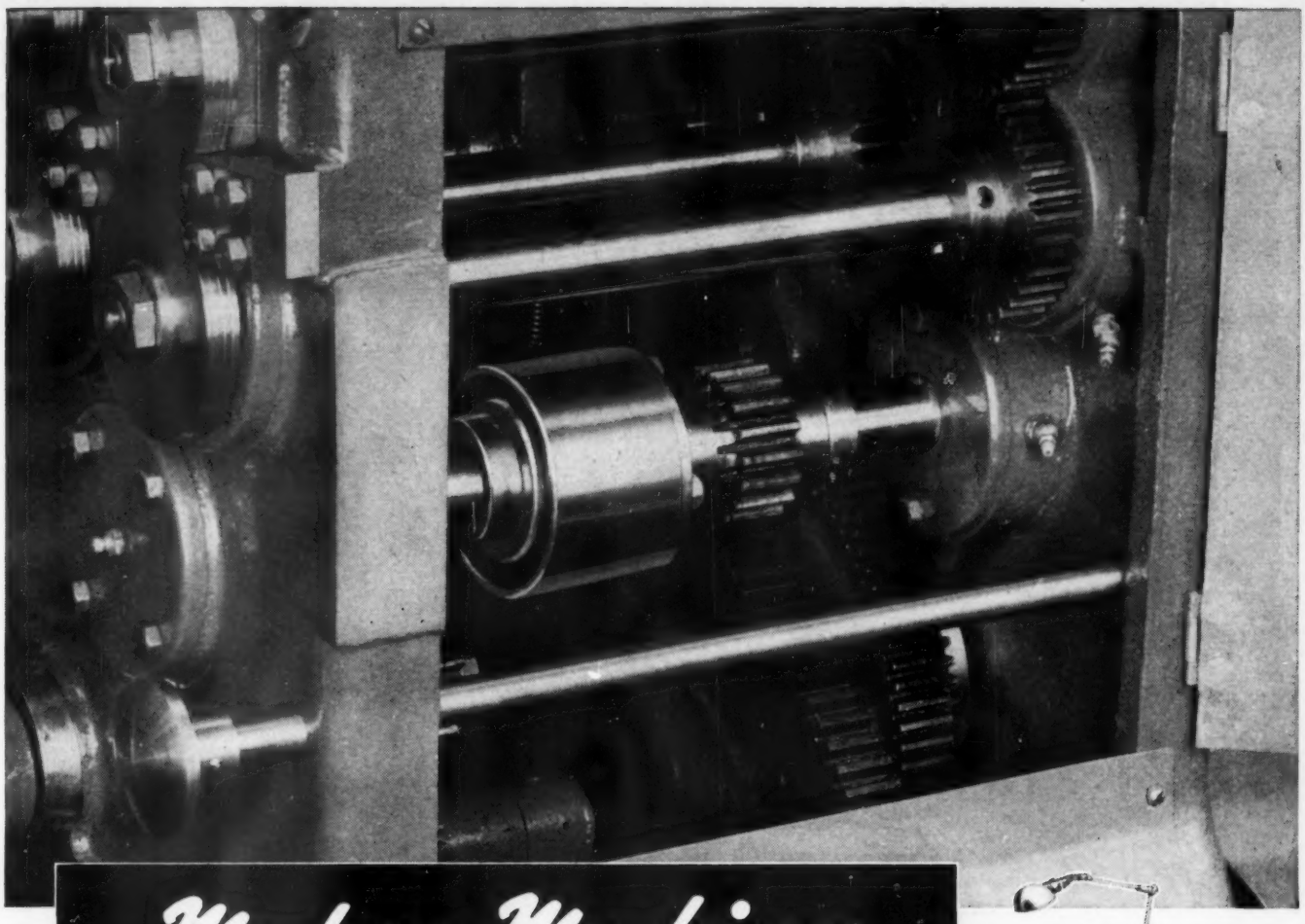
It is entirely new in conception . . . new in valuable features . . . and new in its enthusiastic reception by leading machine designers. We've made good clutches only, for more than 40 years, but the Maxitorq basic principle provides clutch performance far in advance of any previous models.

It is extremely compact yet as rugged as a serviceable clutch must be . . . there's no heating in neutral because the discs are "floated" apart by patented "Separator Springs" . . . while "in" and "out" are fast and positive, controlled with the lightest pressure. Moreover, the entire clutch may be taken apart or adjusted *without tools.* Capacities, ¼ to 15 H.P. at 100 r.p.m.

For really dependable power transmission look to MAXITORQ.
Send for Catalog No. A122

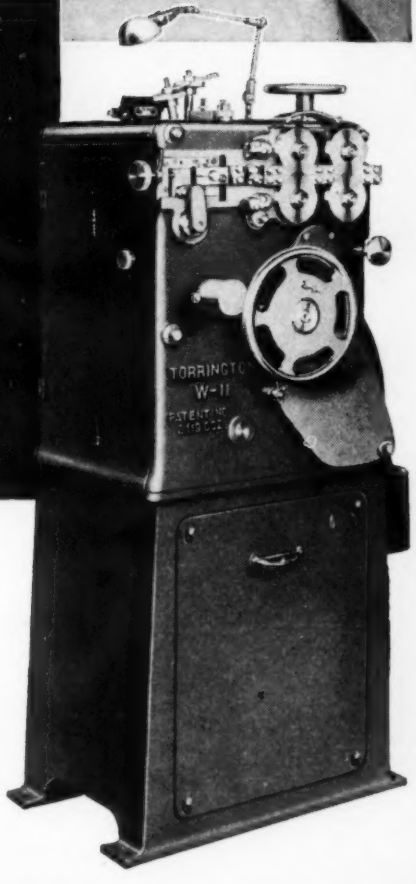
TRADE MAXITORQ MARK

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER CONNECTICUT



Modern Machines Deserve Morse Clutches

FREE WHEELING AND INDEXING



Torrington Spring Coilers work to tolerances of thousandths of an inch. Precision is imperative! Equipped with the Morse Indexing Clutch, Torrington achieves positive and consistent accuracy.

MORSE CHAIN COMPANY • Ithaca, N. Y. • Detroit 8, Mich.

A PRODUCT OF B-W BORG-WARNER

MORSE ROLLER and SILENT CHAINS and COUPLINGS

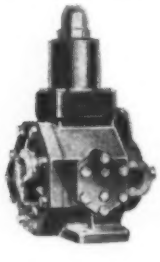
This operator pays his way

PHOTO COURTESY
LUKENS STEEL CO.
COATESVILLE, PA.

The higher cost of man-hours demands an increase in output of usable material. The price you pay — your actual total expense on metal cutting work is governed by two factors — the productivity of your equipment and the quality of the finished cuts.

Racine metal cutting Machines incorporate modern hydraulic feed and control. They cut faster because the blade is correctly applied by Racine's *exclusive progressive feed* throughout the cutting stroke. This scientifically correct feed also insures accurate cuts. No unnecessary turning or milling of excess stock in subsequent machining operations.

For nearly forty years, Racine engineers have specialized in metal cutting problems. Get the facts on the productive capacity of Racine Machines; available in all sizes from 6″ x 6″ to 20″ x 20″. Free catalog No. 12 includes a quick, easy to read description of all models. Write for it today. Also include a brief outline of your metal cutting work.



RACINE OIL HYDRAULIC PUMPS AND VALVES

Use Racine Variable Volume Pumps, Valves and Controls for smooth oil-cushioned power movements. Pump capacities to 30 G.P.M., pressure to 1000 lbs. p.s.i. Valves to 1½″ I.P.S. Ask for catalog P-10-C.

RACINE TOOL AND MACHINE COMPANY, 1751 State Street, Racine, Wisconsin

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RACINE

STANDARD FOR QUALITY AND PRECISION

FREE LITERATURE

New Catalogs, Booklets, Bulletins

MACHINES AND ATTACHMENTS

1 HYDRAULIC PRESSES—R. D. Wood Co., Philadelphia 5, Pa. 75-page catalog covers a variety of presses, including illustrations, description and specifications for each machine. The presses are for many special purposes and general application.

2 JIG BORER—The Foodick Machine Tool Co., Cincinnati 3, Ohio. 24-page catalog No. 5 describes No. 30, 30A, 38 and 42 jig borers. Detailed views and descriptions on these medium-priced machines are included.

3 TRANSMISSION—Portman Machine Tool Co., New Rochelle, N. Y. 24-page bulletin covers hydraulic variable speed transmissions. These units are said to handle frequent, rapid reversals or speed changes.

4 DRILLING MACHINE—Sibley Machine & Foundry Corp., South Bend, Ind. 8-page bulletin No. 64 and 4-page bulletin No. 65 describe line of 20, 24, and 28-in. drilling machines. They can be equipped for electrical reversing when tapping is required.

5 AUTOMATIC CLAMPING — National Automatic Tool Co., Inc., Richmond, Ind. 12-page bulletin 1046 describes automatic clamping-type fixtures with hydraulic and electric operation which are available for many types of Natco mass-production machines.

6 PRESSES—Air-Hydraulics Inc., New York, N. Y. 8-page bulletin describes air-hydraulic press for jig and arbor press operations. Presses operate from shop air lines and deliver pressures up to 50 times intake pressure.

7 TOOL GRINDERS—Gallmeyer & Livingston, Grand Rapids, Mich. 12-page bulletin on No. 60, and 22-page bulletin on Nos. 70 and 80 universal tool grinders give description and specifications and illustrate typical applications. Machines have self-contained motor drives, and are available with portable coolant systems.

8 BENDING AND PUNCHING—Verson All-Steel Press Co., Chicago 19, Ill. Calculator gives the die opening and press capacity required for making 90° bends in mild steel and stainless steel of commonly used gages, and indicates the tons per hole required to punch holes of eight different sizes in mild steel plates in a variety of gages.

9 PRESSES — Watson-Stillman Co., Roselle, N. J. 8-page bulletin 370-C illustrates and gives specifications for general purpose presses of 20- to 200-ton capacity. These presses are designed for short-run jobs.

10 GRINDING—The Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn. 16-page bulletin 146 covers line of grinding machinery, abrasive cut-off machines and grinding wheels.

11 FORGING HAMMERS—Erie Foundry Co., Erie, Pa. 16-page bulletin 337 covers single-frame forging hammers, made in self-contained type from 50 to 300 lb., and standard type in sizes from 250 to 6000 lb. Hammers have double-acting steam pistons.

12 TAPPING—The Cleveland Tapping Machine Co., Hartville, Ohio. 28-page booklet contains data and information designed to assist the estimator, set-up man, and operator in production tapping.

TOOLS AND ACCESSORIES

13 DUST COLLECTOR—Manufactured by Aerotec Co., White Plains, N. Y. Distributed by Thermix Engineering Co., Greenwich, Conn. 4-page bulletin 310 covers integral dust collector, a "packaged" collector for grinding and buffing operations.

14 CARBIDE TOOLS—Nelco Tool Co., Inc., Brooklyn 31, N. Y. 28-page catalog covers line of Carboloy-tipped shell mills, face mills, end-mill cutters, half-side mills, sidemilling cutters, end mills, keyseat cutters, solid Carboloy reamers, twist drills, core drills and diamond wheels.

15 DIAMOND TOOLS—J. K. Smit & Sons, Inc., New York 7, N. Y. Catalog covers line of diamond tools, illustrates applications and contains general information.

16 TOOL CARE — Celfor Tools, Div. Clark Equipment Co., Buchanan, Mich. 24-page bulletin contains engineering data on the care and operation of Celfor drills. Discusses tool selection, balance between tool capacity and job requirements, and tool maintenance and rehabilitation.

17 TEST EQUIPMENT — Hydraulic Machinery, Inc., Dearborn, Mich. 16-page bulletin covers aircraft test equipment for standardized tests of tubing, valves, cylinders, pumps and gages and specialized units for checking various assemblies.

18 ABRASIVE PRODUCTS — Mid-West Abrasive Co., Owosso, Mich. 32-page catalog No. 25 illustrates and describes a variety of abrasive products including hones, disks, stones, and rubbing brick.

19 SAPPHIRE — Sapphire Products Div., Elgin National Watch Co., Aurora, Ill. 8-page bulletin describes use of sapphire as a production tool, giving characteristics, performance and properties.

20 DRILL SHARPENING — Republic Drill & Tool Co., Chicago 7, Ill. 24-page booklet G-1 discusses correct principles of sharpening twist drills. Contains detailed data on care, sharpening, and web spinning.

21 FIXTURES—Barnes Drill Co., Rockford, Ill. 16-page bulletin describes application of hydraulic production units and electrical, pneumatic, and manually-operated holding and indexing units to various machine set-ups.

22 COLLETS—Modern Collet & Machine Co., Ecorse 18, Mich. 36-page catalog covers complete line of products including collets, pushers, screw machine cams, gears and replacement parts. Also describes machine rebuilding service.

HEAT-TREATING AND WELDING

23 ARC WELDERS—K. O. Lee Co., Aberdeen, So. Dak. 6 catalog pages illustrate and describe "Knock-Out" ac. arc welders which can be used singly or in pairs when additional amperage is needed. Three models have maximum amperage of 180, 200, and 275.

Example

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Title. Supt.....
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AMERICAN MACHINIST, New York

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24 FLASH WELDING—Sciaky Bros., Inc., Chicago, Ill. 28-page book covers series BV and BMV flash-butt welding machine for mild steels, alloy steels, aluminum and other metals. Includes explanation of principles of flash-butt welding.

25 INDUCTION HEATING — Tocco Div., The Ohio Crankshaft Co., Cleveland 1, Ohio. 59-page book covers general history, principles and applications of induction heating. Illustrated with pictures, charts and graphs.

26 RESISTANCE WELDING—Ampco Metal Inc., Milwaukee 4, Wis. 20-page bulletin 68-A describes Ampcoloy resistance welding electrodes and alloys. Includes data on a new line of watercooled electrode holders.

27 ELECTRIC FURNACES — C. I. Hayes, Inc., Providence, R. I. 20-page catalog No. 108 covers line of electric furnaces which have precision control of furnace atmospheres by the "Certain Curtain" pre-combustion method.

28 WELD CLEANING—Chicago Mfg. & Distributing Co., Chicago 9, Ill. 16-page bulletin covers all phases of weld cleaning and provides instructions for both experienced welders and beginners.

29 ELECTRODES—Hollup Corp., Div. National Cylinder Gas Co., Chicago 50, Ill. 64-page catalog covers all Hollup electrodes and National-oxy-acetylene gas welding rods. Includes tables on weldability of metals, appearance inspection of welds, electrode consumption estimating chart and definitions of welding terms.

30 CARBURIZER-NITRIDER — Hevi Duty Electric Co., Milwaukee, Wis. 28-page bulletin HD 646 describes carburizer-nitrider which provides circulation of furnace atmosphere up to 1850 F. Can be operated to produce accelerated cooling outside the furnace which maintains protective atmospheres.

31 AMMONIA—The Mathieson Alkali Works, New York 17, N. Y. 40-page booklet "Ammonia in Metal Treating" explains use of ammonia either in the furnace atmosphere or in the source of pure hydrogen in nitriding, dry cyaniding, bright annealing, copper brazing, powder metallurgy, atomic hydrogen arc welding and oxy-hydrogen arc welding.

PLANT SERVICE EQUIPMENT

32 RUBBER PRODUCTS—B. F. Goodrich Co., Akron, Ohio. 28-page booklet describes line of industrial rubber products including flat transmission belting, conveyor belting, V-belts, hose and couplings and other items.

33 CHAIN HOISTS — Reading Chain and Block Corp., Reading, Pa. 36-page booklet No. 60 discusses hoist selection, type, insulation methods, and gives data on the comparative strength of wood and steel I-beam for mounting purposes.

34 ELECTRIC HOISTS—Lisbon Hoist and Crane Co., Lisbon, Ohio. 8-page bulletin describes "Bob-Cat" line of electric cable hoist. These hoists have capacities from 200 to 4000 lb.

35 WASHING — B. F. Goodrich Co., Akron, Ohio. 4-page bulletin describes spray-type pickling and washing machine. The machine is lined with rubber.

36 LIFT TRUCK — Clark Tructractor, Battle Creek, Mich. 16-page bulletin describes Truckloader, a fork lift truck small enough to maneuver in the loading area of highway trucks and trailers. It carries loads up to 1000 lb.

37 SPRAY BOOTH — Nevcomb-Detroit Co., Detroit 11, Mich. 16-page bulletin covers water tube spray booth, describing principles and giving specifications. The booth is said to eliminate 80 to 90% of the assembly time normally required on delivery.

38 CHAIN HOIST—Chester Hoist Co., Lisbon, Ohio. 16-page bulletin covers line of spur-geared (high speed) and differential chain hoists. Included are Army-type low head-room trolley hoists.

39 AIR COMPRESSORS—Quincy Compressor Co., Quincy, Ill. 146-page manual for servicing air compressors contains service data and parts list. Available to authorized service men.

PARTS AND MATERIALS

40 CASTING RESIN—Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. 12-page bulletin gives technical discussion and instructions for use of Durez 7421-A casting resin. This is a phenolic thermosetting resin in liquid form which can be cast in simple molds without the use of pressure. They are baked 8 hours at 140 F.

41 PLASTICS — Cellulose Products Dept., Hercules Powder Co., Wilmington, Del. 32-page periodical "Cellulose Plastics" describes various applications. First issue includes article describing extrusion of rocket propellant.

42 LEATHER PACKING — Chicago Melting Co., Chicago 7, Ill. 62-page catalog covers design and application of hydraulic and pneumatic leather packing.

43 FASTENING DEVICES—The H. M. Harper Co., Chicago 18, Ill. 4-page bulletin contains condensed information on bolts, nuts, screws, washers, rivets and nails.

44 STEEL BARS—Monarch Steel Co., Indianapolis, Ind. 24-page bulletin covers Speed Case and Speed Treat cold-finished steel bars. The steel can be machined at 220 to 300 sfpm.

45 GEARS—Indiana Gear Works, Indianapolis, Ind. 16-page bulletin "Production Doesn't Cost—It Pays" gives case histories of savings through the use of facilities for production of gears, cams, and other parts.

46 MOTORS—The Louis Allis Co., Milwaukee 7, Wis. 12-page bulletin No. 720 covers type OG (protected type) Standard Squirrel Cage Induction motor. Illustrations show features and typical applications.

47 LEATHER PACKING — Alexander Bros., Philadelphia, Pa. 20-page bulletin on hydraulic and pneumatic leather packings covers usage, types, sizes, and other data.

48 LUBRICATION CHART—The Rapids-Standard Co., Inc., Grand Rapids 2, Mich. 2-page lubrication chart for standard gear motors used on Rapids Standard power belt conveyors explains in detail how to lubricate and maintain operating efficiency.

4 CASTING—Mechanite Metal Corp., New Rochelle, N. Y. 4-page bulletin No. 23 discusses the use of Mechanite in permanent mold casting. Illustrates molds used in the production of metal, glass, plastics and rubber.

50 STEEL SHAPES—The Commercial Shearing & Stamping Co., Youngstown, Ohio. 20-page Shape Book No. 7, covers standard steel shapes which are offered without tool or die charges.

51 STEEL—Steel & Tube Div., of the Timken Roller Bearing Co., Canton 6, Ohio. 68-page booklet describes facilities and products. Products are illustrated and tabular data is included.

52 SPEED REDUCERS — Philadelphia Gear Works, Inc., Philadelphia 34, Pa. 8-page bulletin 250 covers air-cooled worm-gear speed reducers. Includes description and detailed specifications.

53 STEEL—United States Steel Corp., Pittsburgh 19, Pa. 68-page booklet gives complete data on properties, fabrication, and application of Cor-Ten. Includes illustrations of present and potential applications for this high-tensile steel.

MISCELLANEOUS

54 CONTRACT WORK—General Mills, Inc., Mechanical Div., Minneapolis 13, Minn. 12-page bulletin describes production facilities for the manufacture of parts, assemblies or complete products on a contract basis. An accompanying booklet lists machine tool facilities.

55 SHOP MANAGEMENT — Bynell Machine & Tool Co., Cleveland 4, Ohio. Three 8-page booklets by M. O. Shepherd, Works Manager, discuss the captive shop, obsolescence, and contributions of the tool and die shop.

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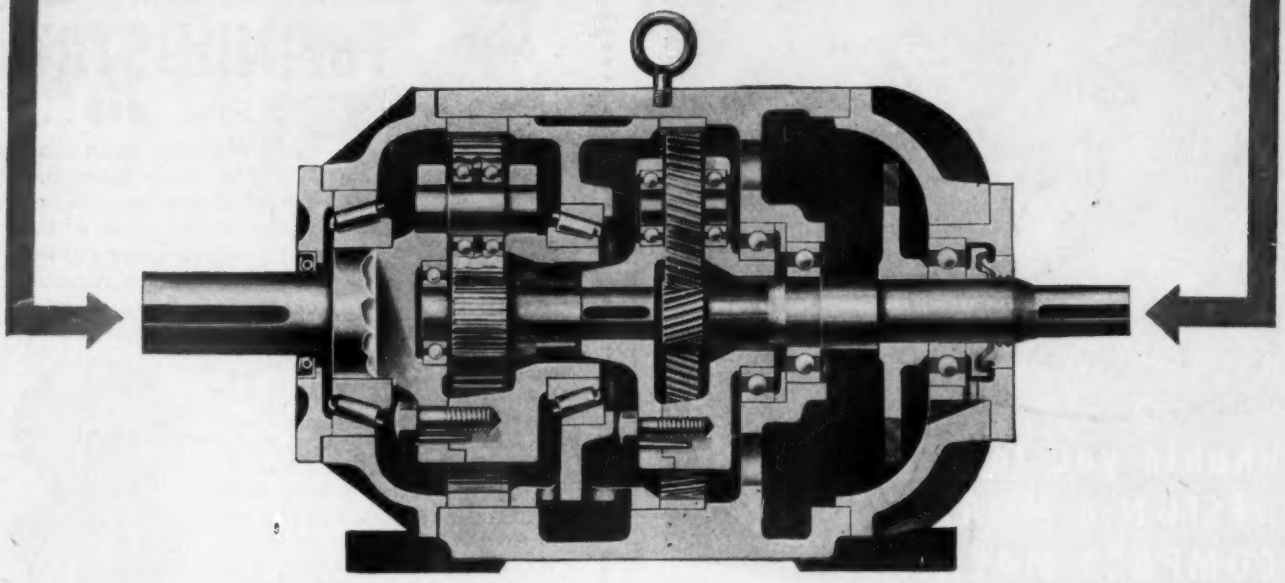
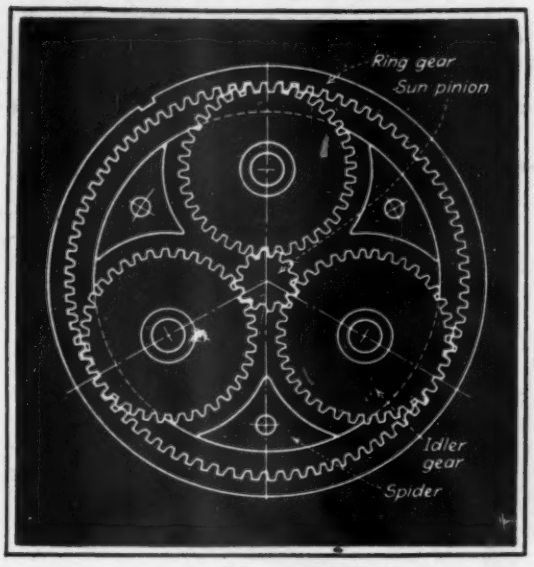
TRULY, A "STRAIGHT-LINE" DRIVE



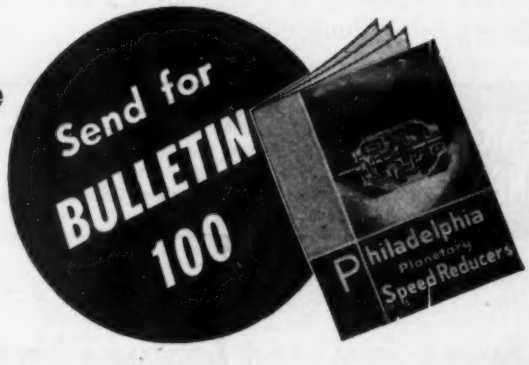
. . . *the* PHILADELPHIA "PLANETARY" REDUCER



Drawing above shows how sun pinion, idler and ring gears mesh in a planetary system. Gears are of heat treated steel, and mounted entirely on ball or roller bearings. The sun pinions each mesh with three equally spaced idlers, thus reducing pitch line velocity, noise and wear. Gear ratios cover a range of 4 to 1 up to 106 to 1, with sizes up to 100 H.P. Efficiencies as high as 98% are obtained.

This widely used Unit is distinctly superior to the "old spur gear type" Speed Reducer—and has many advantages over parallel shaft reducers. Compactness and ruggedness are inherent in the Planetary form of gearing (see illustrations herewith)—and it is well suited for installations where space is limited—where neat appearance is desired—and where a simple base plate design is preferred; then too, it is very well balanced and neat in appearance.

Also available in Double Reduction Units



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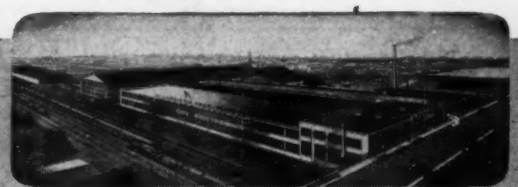

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LimiTorque Valve Controls

Sier-Bath Precision Gears

enable you to
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COMPACT MACHINE

● Machine Designers know that if you reduce the T.A.E. (Total Accumulated Error) in gear manufacture, you can also reduce the size of the gear, and make a more compact machine. Sier-Bath Precision methods cut down T.A.E. to the practical minimum. This enables Sier-Bath Gear trains to support heavier loads and faster speeds than regular commercial gears. Sier-Bath uses such up-to-the-minute machines as the Red Ring Shaver, the Sykes Generator, the J. & L. Thread Grinder. Sier-Bath eliminates manual, visual and thermal checking errors by using mechanical recording checkers in an air-conditioned, constant temperature checking room. Distortion is reduced to a minimum by constant temperature quenching baths, controlled atmosphere furnaces, quench presses, flame hardeners. Let us quote on your job.

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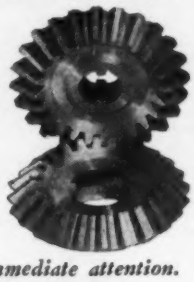

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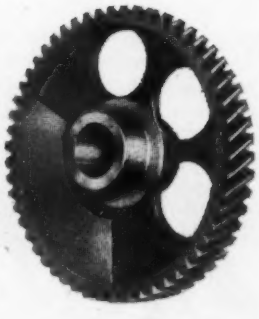

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Radial, Single Row, Ground
Radial, Single Row, Precision
Radial, Single Row, Unground
Sheaves, Pressed Steel
Thrust, Ground
Thrust, Ground, Heavy Duty
Thrust, Light Duty
Thrust, Unground
Wheels, Pressed Steel

BEARINGS, OILITE
Bronze, Precision, Oil-Cushion

BUSHINGS
Steel (For Hole Reduction)

CHAIN
Block
Ladder, Brass, Small Pitch
Ladder, High Tensile Steel, Small Pitch
Ladder, Steel, Small Pitch
Roller, Attachment, Standard
Roller, Double
Roller, Single, Non-Corrosive
Roller, Single
Stud, Small Pitch

COLLARS
Setscrew, Standard Shafting

COUPLINGS
Flexible, Ball Bearing Insert Type
Flexible, Rubber Insert, Heavy Duty
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6 to 80 Diametral Pitch

GEARS, BEVEL
Brass, Small Pitch
Steel and Iron

GEARS, HELICAL
Bronze
Steel, Hardened

GEARS, INTERNAL
Brass, Small Pitch

GEARS, MITER
Brass, Small Pitch
Iron
Steel

GEARS, MITER, SPIRAL
Steel

GEARS, SPUR
Brass, Small Pitch
Brass, Sheet, Small Pitch
Change Gear Type
Fabroil
Non-Metallic
Pinions, Stem, Steel (5–10 Teeth)
Steel, Small Pitch
Steel and Iron
Steel and Iron (20° P.A.)

GEARS, WORM
Bronze, Single Thread
Bronze, Single Thread, Small Pitch
Bronze, Double Thread
Bronze, Double Thread, Small Pitch
Bronze, Four Thread
Bronze, Four Thread, Small Pitch
Iron, Single Thread
Iron, Double Thread
Iron, Four Thread

PILLOW BLOCKS
Ball Bearing, Flanged Cartridge Type
Ball Bearing, Self Aligning
Ball Bearing, Welded Steel
Cast Iron, Split
Cast Iron, Split, Oilite Bearing

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Brass
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Brass, Grooved, Round Belt
Iron, Cone, Round & V-Belt
Iron, Grooved, Round Belt
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Brass
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Horizontal Drives, 1/20 up to 3 HP
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Ball Bearing, Precision, Self Aligning
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Block Chain, Steel and Iron
Ladder Chain, Bronze and Steel
Roller Chain, Double, Steel and Iron
Roller Chain, Single, Steel and Iron
Stud Chain, Brass

UNIVERSAL JOINTS
Steel, Bored
Steel, Unbored

WASHERS
Steel, Hardened, Thrust Type

WORMS
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Steel, Single Thread, Small Pitch
Steel, Double Thread
Steel, Double Thread, Small Pitch
Steel, Four Thread
Steel, Four Thread, Small Pitch
Steel, Hardened and Ground
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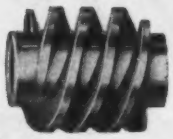

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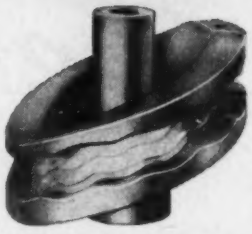
You plan and we execute—assuring speedy production, prompt delivery and reasonable price. Send blue prints or samples for estimate.



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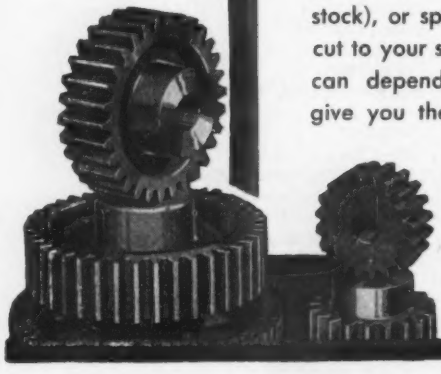

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and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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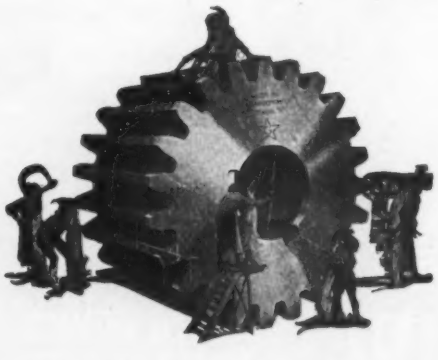

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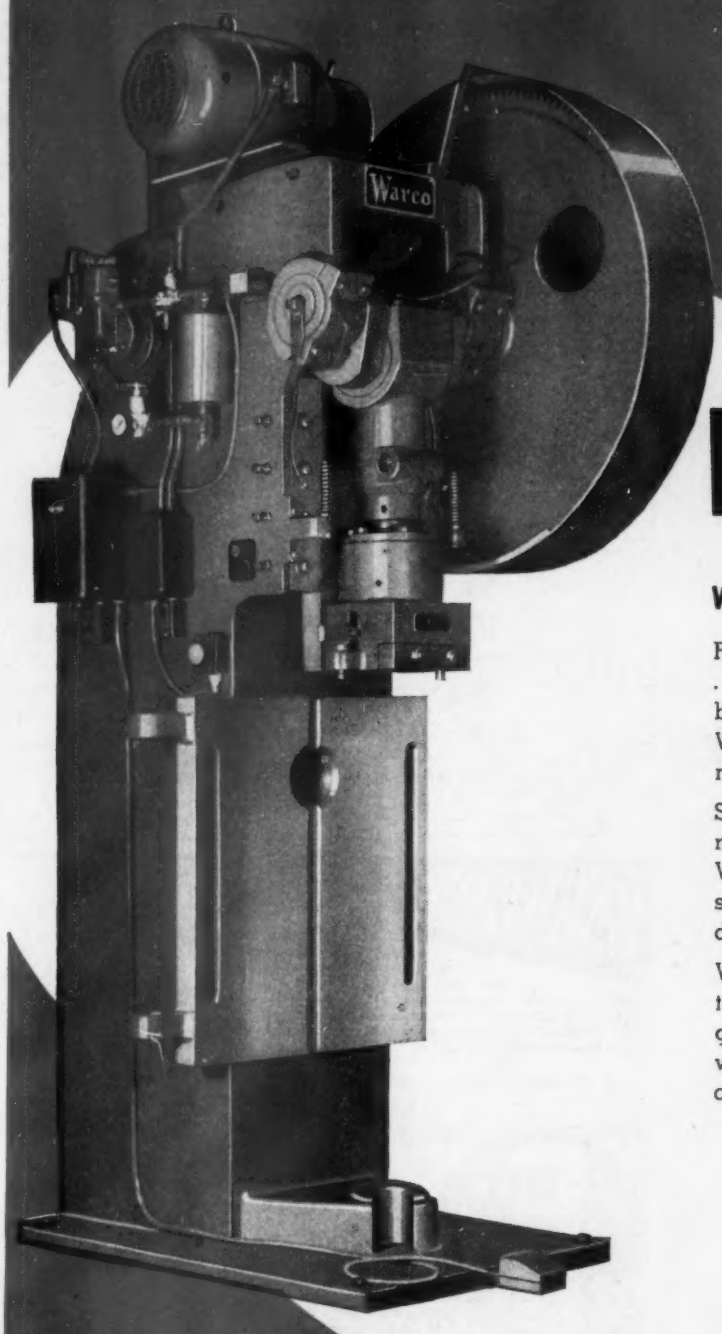

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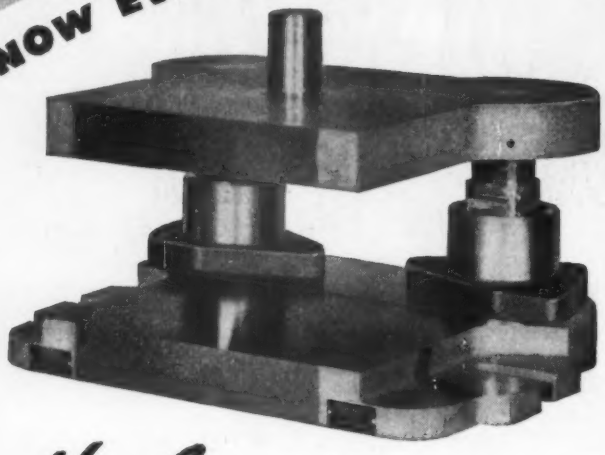

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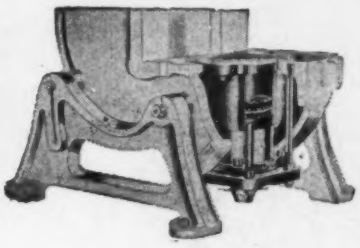
No matter how you figure it Dayton Rogers Die Cushions will assure better results and lower production costs on your punch press operations because:



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All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

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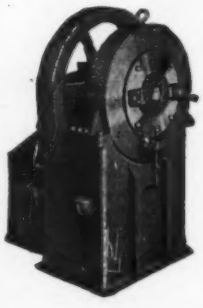

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— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

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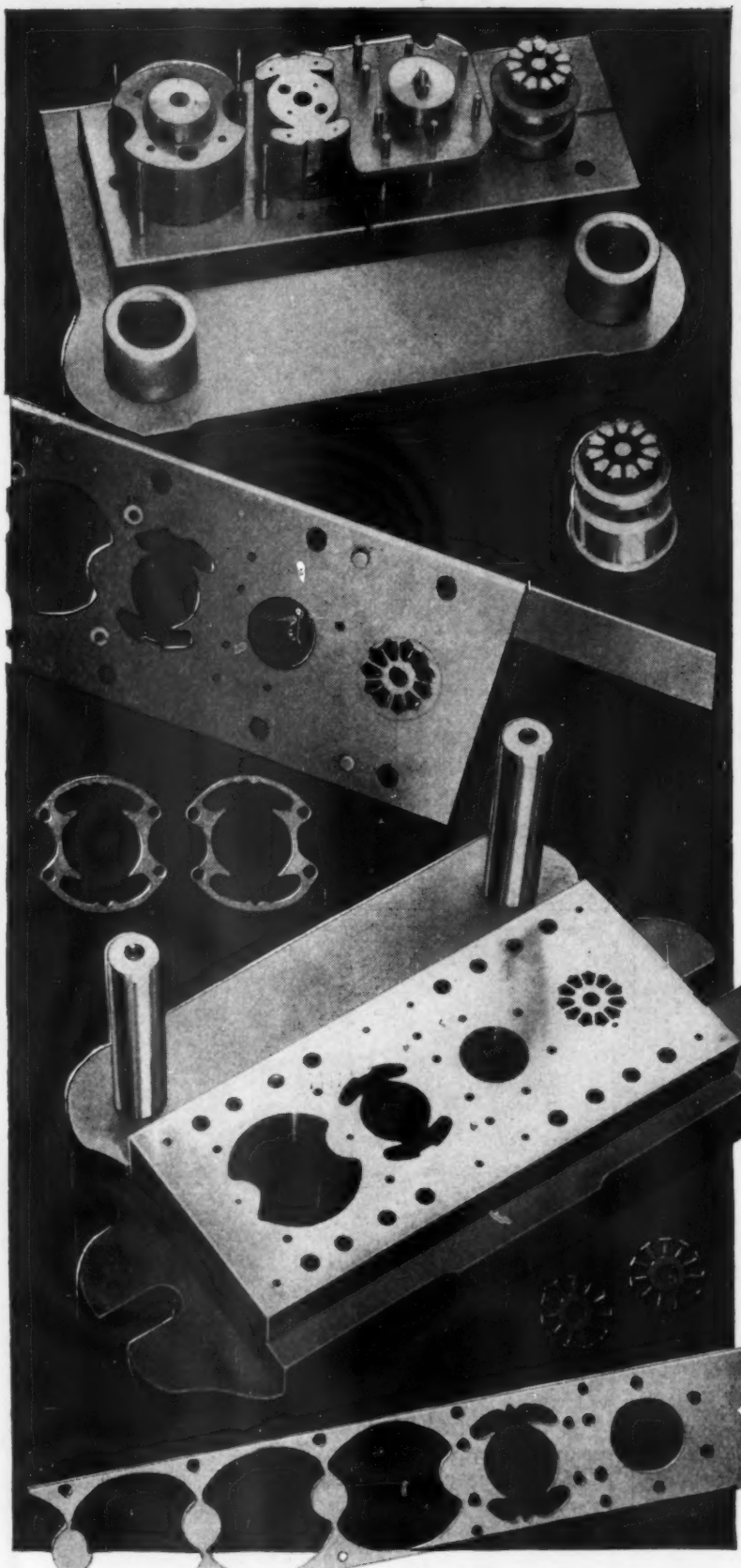

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High Speed Steel Die

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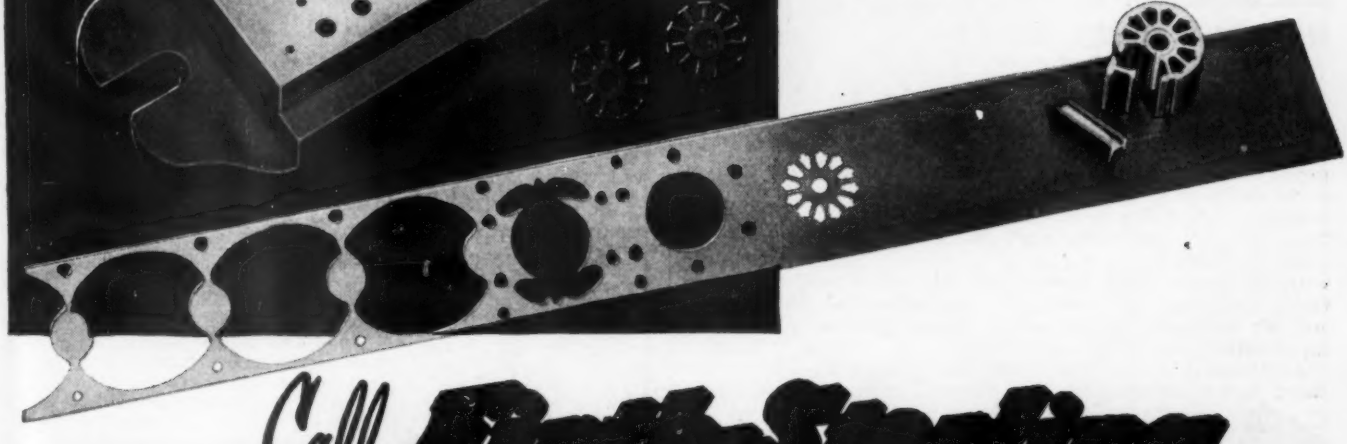
- **furnishes blanks free from burrs**

The remarkable performance records being made by this Blue Chip Blanking Die for motor laminations are typical of Firth-Sterling quality and precision. What is your die problem?



Call **Firth-Sterling**

STEEL COMPANY

McKEESPORT, PA. · NEW YORK · HARTFORD · PHILADELPHIA · PITTSBURGH · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

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SAVES TIME
MAKES MONEY
★
CUTS ANY SHAPE
CUTS ANY SIZE
★
CAPACITY UP TO
¼" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

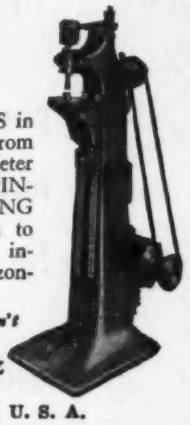
MARSHALLTOWN MANUFACTURING COMPANY
910 Nevada Street — Marshalltown, Iowa

GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to ⅜" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.



CRAFTS
DIAMOND TOOLS
Consistent Quality

CARBIDE-TIPPED MACHINE SHOP
GAGES AND TOOLS
ARTHUR A. CRAFTS CO., INC.
603 NEWBURY ST., BOSTON 15, MASS.
PLANTS: CHICAGO, DETROIT, BOSTON

of TRIMMING FORMED PARTS
and performing a host of other metal cutting jobs!

The negligible down-drag and the ability of Tannewitz High Speed Band Saws to cut sheet metal from 90° to near 0 or 135° at tremendous speed make these machines ideal for trimming. Cuts can be made with perfect safety without using a rest of any kind. Friction sawing with Tannewitz High Speed Band Saws also results in perfectly amazing time savings in the cutting of flat sheets, soft or hardened steels, armor plate, plastics, glass and many other materials. Whatever your cutting problem, chances are it can be done better and faster with Tannewitz Band Saws. Investigate this "Super" method of cutting.

Write for Your Free Copy

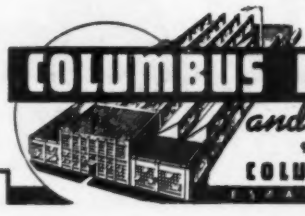
FRICTION SAWING with Tannewitz
HIGH SPEED BAND SAWS

THE TANNEWITZ WORKS GRAND RAPIDS 4, MICHIGAN

NOTHING UP OUR SLEEVES-
It's All in the TOOL!

We design particular tools to do particular jobs, easily, precisely, at low cost. No tooling order is too small, no tooling difficulty is too big for us to handle. Your tool designing problems are a challenge to our ingenuity, mechanical skill, and over 40 years of sound experience.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES



COLUMBUS DIE·TOOL and Machine Co.
940 CLEVELAND AVE.,
COLUMBUS 1 OHIO
ESTABLISHED 1906

Plants are obtaining more production per man-hour with Niagara Power Squaring Shears because of accurate cutting, quick setting, ball bearing, self-measuring parallel back gages, full visibility of cutting line, instant acting Niagara sleeve clutch and other modern features.

Enclosed drive with gears, clutch and eccentrics running in oil assure long life and low maintenance cost. Four-edge, solid tool steel knives are standard equipment. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Detroit, Cleveland, New York.

Shear knives available for cutting alloy and special steels. Let us know what you desire to cut. Prompt delivery on spare knives for Niagara Squaring Shears. Also factory regrinding service by the same skilled men who grind new Niagara knives.

do YOU have a Cat to SKIN?

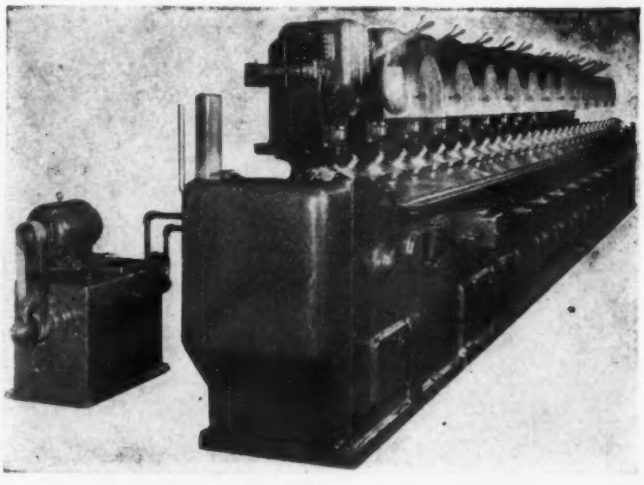
THAT old one about "... way to skin a cat" applies to many production problems, but all to often there is not more than one *profitable* solution. That's one reason for letting specialists like Sommer and Adams bring their know-how into your planning when you have a particularly tough one to skin.

Shown here are two examples of S & A "Productioneering" . . . applicable to a variety of special production problems.

The five station, multiple-spindle S & A machine above was designed to automatically drill, ream, counterbore, chamfer and tap large automotive parts at a high production rate. The number of stations, or the number of spindles YOUR machine might have would depend upon the needs developed by analysis of your problem.

The multiple head, horizontal polishing machine, with traveling fixtures (below) was the ONLY answer to another particular "faster-production-lower-cost" headache. Sommer and Adams lifetime of experience with special high precision, high-production machinery can serve YOU if you will just let us make a Productioneering proposal on one of your out-of-the-ordinary jobs.

NOTE: One of these machines, with fixtures for polishing axe and hatchet heads (two sides) at 200 per hour now available for immediate delivery.



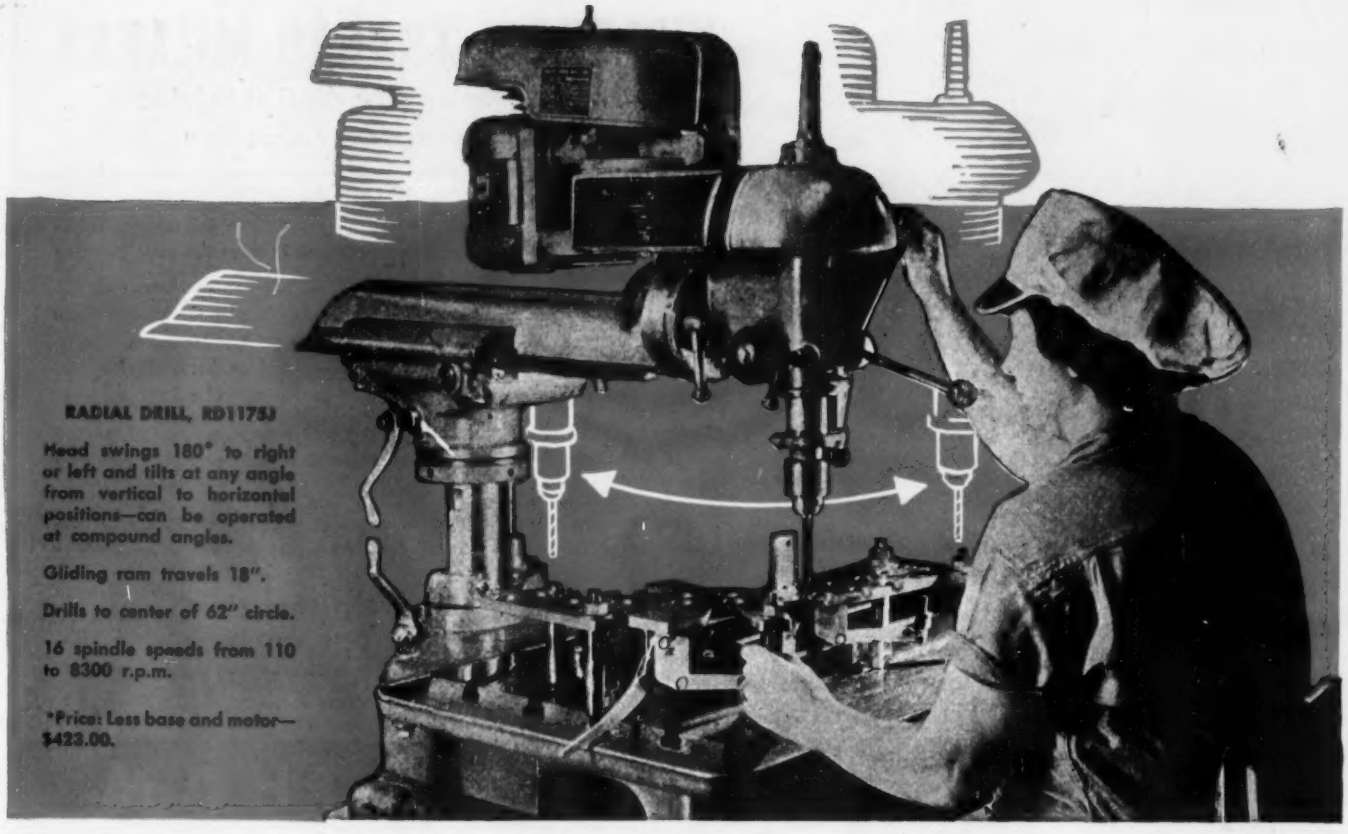
S&A

THE SOMMER AND ADAMS COMPANY

18501 EUCLID AVE. • CLEVELAND, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES

SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY



RADIAL DRILL, RD1175J

Head swings 180° to right or left and tilts at any angle from vertical to horizontal positions—can be operated at compound angles.

Gliding ram travels 18".

Drills to center of 62" circle.

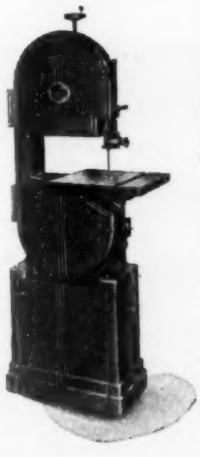
16 spindle speeds from 110 to 8300 r.p.m.

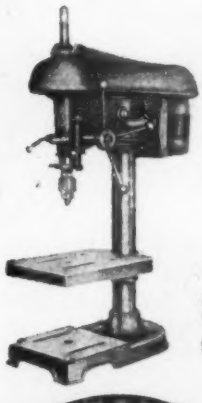
*Price: Less base and motor—$423.00.

WHERE THE EASIEST WAY IS BEST

14" METAL CUTTING BAND SAW—MBN935

Speeds: 61 to 4630 s.f.m., Table tilts 45° — Equipped with mitre gauge grooves—*Price: Less base and motor—$153.00.





15" DRILL PRESS BENCH MODEL—D950

Spindle travel 4¼"—Speeds: 480 to 5000 r.p.m. *Price: Less motor and belt guard—$56.25.

This Radial Drill is typical of a family of Walker-Turner metal working machines that are safe, fast and easy to learn to operate. It's the easiest way to meet everchanging production specifications with lowest overhead and operating costs.

The operator moves the drill to the work—many times on the piece shown. Full vision, easy manipulation—and speed without fatigue—all day long.

A study of the specifications indicates how well it will do your present work and how quickly it can be adapted to a new product or a new material.

Walker-Turner Machines are also the easy way to reduce overhead costs. By increasing production, they write off their low first cost in a few months—wherever metals, wood or plastics are drilled, cut or shaped. The Walker-Turner General Catalog will be sent on request. 22

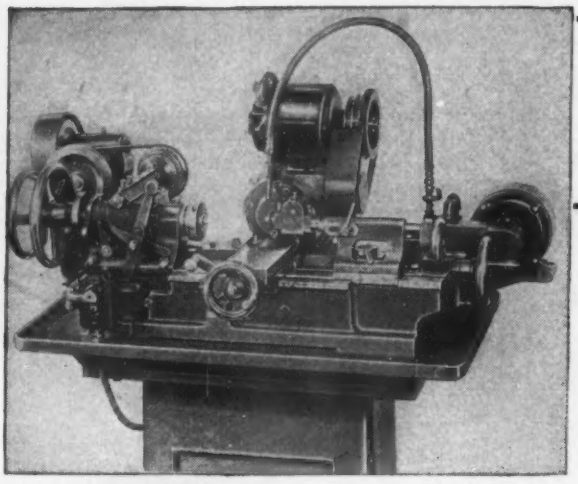
*F.O.B. Plainfield—slightly higher west of the Rockies and in Canada

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS

walker-turner COMPANY, Inc. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS



WALTHAM THREAD MILLERS

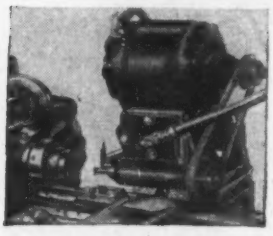
provide versatility and precision in small thread production

Designed especially for small work calling for close tolerances, WALTHAM THREAD MILLERS can be depended on to meet the most exacting specifications for precision parts.

An outstanding feature of these improved machines is the use of three motors, one each for driving cutter, work and pump. Machines can be arranged with speeds suitable for brass or steel or both. Motors are wired so that a single start and stop station will control all at one time.

Standard equipment includes three motors with control, follow rest, milling cutter, indexing device, 5 pitch lead screw and change gears for cutting from 5 to 40 threads per inch.

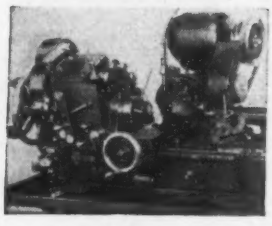
A wide range of special equipment is available and greatly enlarges the usefulness of this machine. Full details on request. Write for Bulletin 244A.



(Left)—Waltham Thread Miller equipped with Internal Threading Attachment.

•

(Below)—Waltham Thread Miller equipped with Relieving Head.



CONDENSED SPECIFICATIONS

Swing over carriage—3"
Dia. work handled—2" or smaller
Thread length (work held on centers)—8¾"
Thread length (work held in chuck)—10"
Max. Dist. between centers—12"
Floor Space—48"x34"
Net Weight—850 lbs.

WALTHAM
TRADE MARK REGISTERED U.S. PAT. OFF.

WALTHAM MACHINE WORKS,
WALTHAM, MASS.

Proof of LOWER PRODUCTION COSTS

with REED Triple-Die

1200 THREADS an hour

Part: Hollow Bushing

Thread: 15/32"—32 NS—Class 5

Material: Stainless Steel

Rolled on the REED Cylindrical-Die THREAD ROLLER Model A22

For complete specifications, write for Bulletin A22-1.

Prove it to your own satisfaction! Send us specifications of your work and let us roll samples. We will furnish production estimates and equipment costs.

REED A22
for
THREADING
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KNURLING
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BURNISHING
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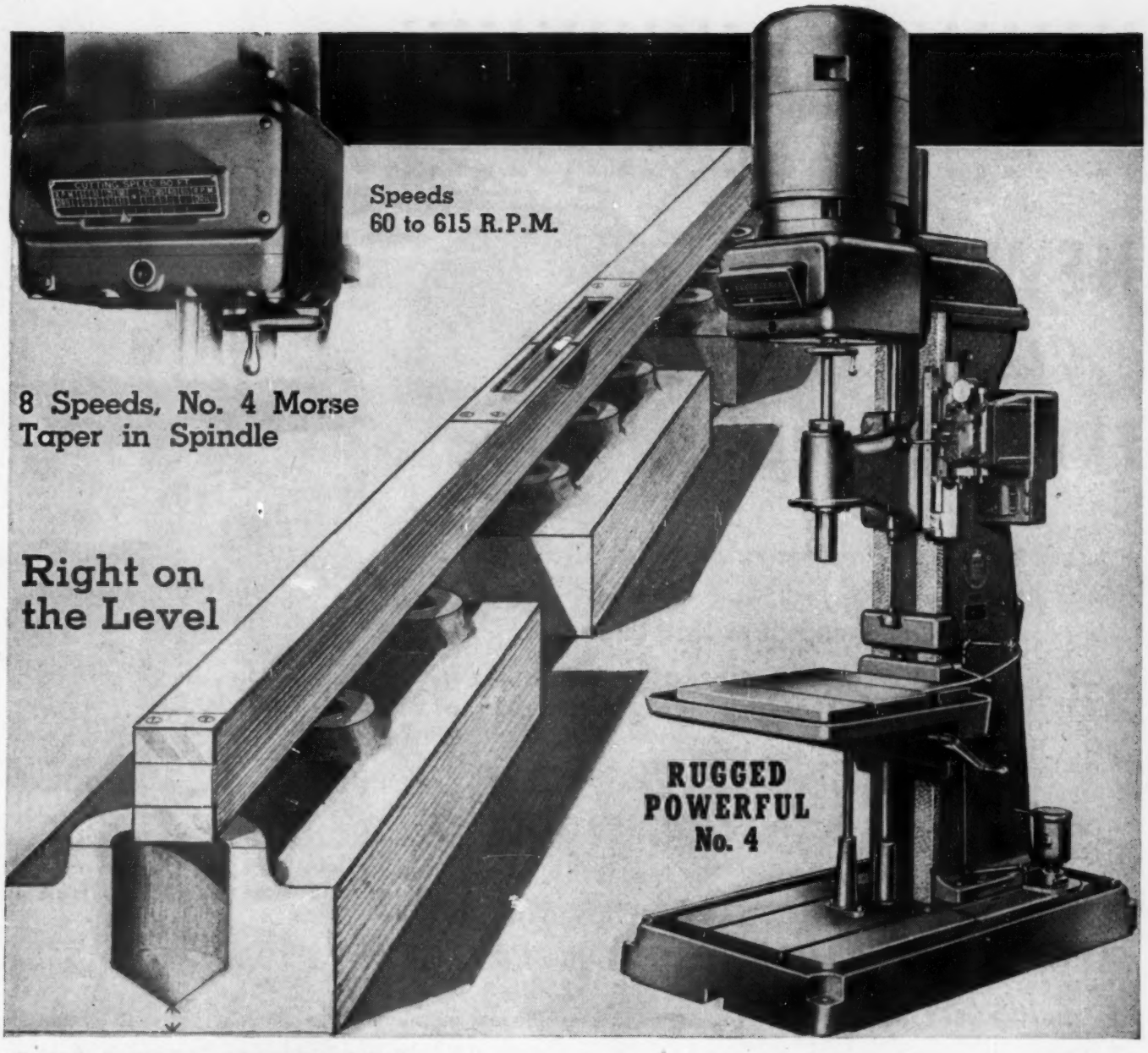
ROLLED THREAD DIE CO.
Thread Rolling Dies and Machines
237 Chandler Street - Worcester 2, Mass., U. S. A.



LELAND-GIFFORD Hydraulic Drilling Machine

for ***Accurate Depths*** in Counterboring
Accurate Heights in Spot Facing
Uniformity from piece to piece

assured by the positive but easily adjustable metal to metal depth stop.

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

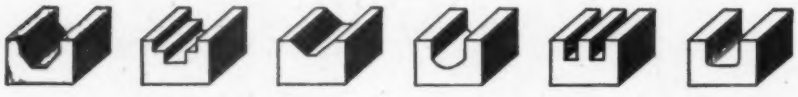
Minimum Investment-Maximum Production

NEW-FIELD *Universal* FLY CUTTERS

. . . **REDUCE** inventory and maintenance costs.

. . . **SAVE ON** time, labor and expense.

. . . **BECAUSE** one easily adjustable New-Field Fly Cutter performs a variety of production jobs.



FOR FLAT SURFACE-STRADDLE MILLING-SLOT CUTTING ON ALL METALS & PLASTICS

The New-Field fly cutters provide an economical and efficient means of putting your idle standard tool bits to work. Designed for high speed or carbide tool bits, the New-Field Fly Cutters provide you with a wide range of special shaped milling cutters.

NO COSTLY PRODUCTION LAGS due to broken or dulled cutters . . . simply remove the defective bit and continue operation. The New-Field Meehanite cutter bodies, developed specifically for efficient FLY-WHEEL ACTION, absorb vibration, prevent tool chatter, reduce power requirements and increase cutter life.

MORE CHIP REMOVAL per horsepower with New-Field Fly Cutters. Regular models; 4" to 10" diameters—5/8" to 1" widths. Extra Heavy 6" and 8" diameters—1 3/8" width.

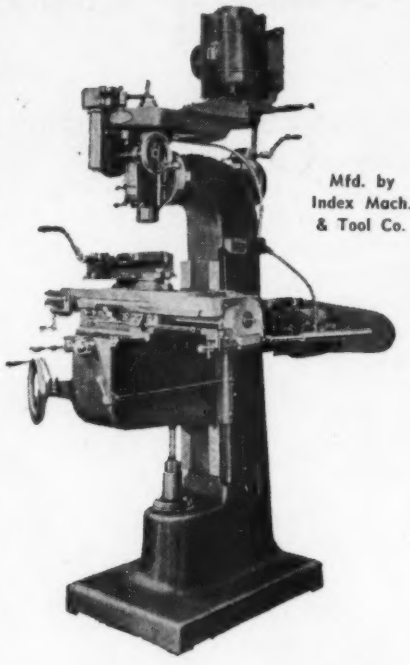
Write for descriptive bulletin.

NEW-FIELD MACHINED PARTS CO.
General Offices: 549 W. Randolph St., Chicago 6, Ill.
Factory: 7160 Melrose Ave., Los Angeles 46, Calif.
Export Division: 80 Broad St., New York 4, N. Y.

THE TREND IS TO NEW-FIELD

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table

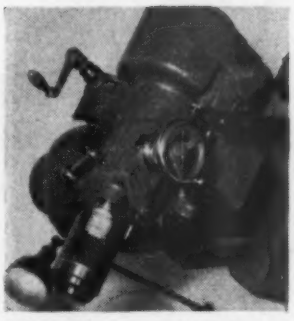
A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

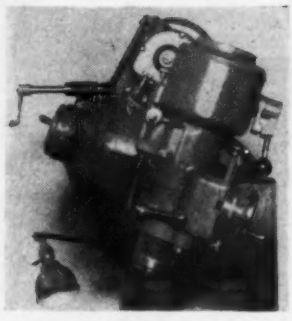
BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

The 12-V UNIVERSAL HEAD VERTICAL MILLER... CUTS TOOLROOM COSTS!



Universal head swivels 45 degrees front and back of vertical.

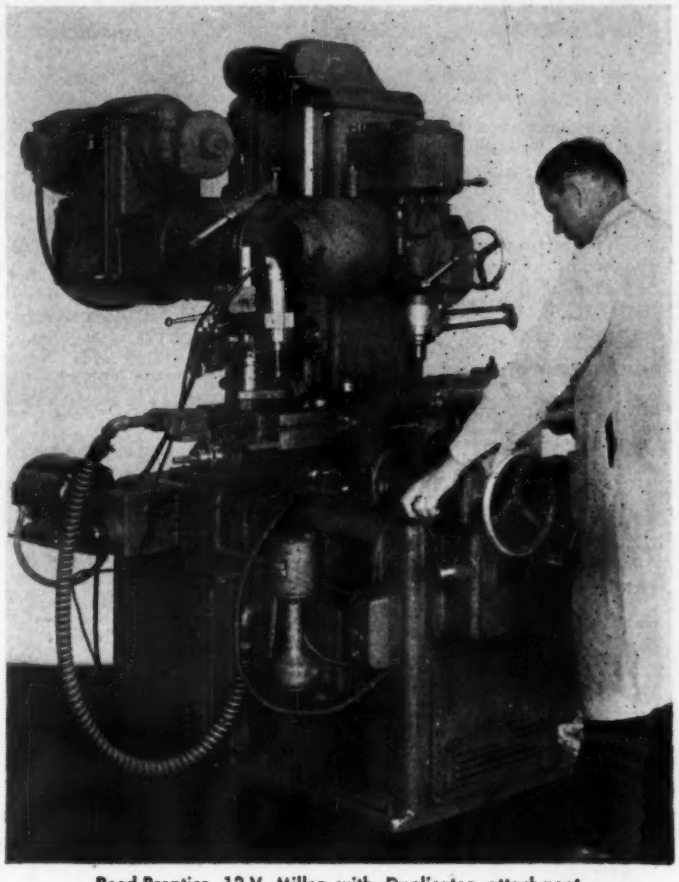


Universal head swivels 30 degrees left and right of vertical.

because...

1. The universal head permits wider range of work with minimum set-up time.
2. This all-purpose 12-V is a high speed miller, die sinking and boring machine — all in one.
3. It's natural versatility is increased by provision for high speed milling and slotting attachments.
4. The central electronic panel gives instant control of infinitely variable feeds and speeds — lessens operator fatigue.
5. One shot lubrication guards against excessive wear of moving parts — insures long, trouble-free production.
6. Gears are easily accessible for periodic inspection.
7. Perfect balance of universal head on vertical saddle insures minimum wear and maximum accuracy.
8. All motors foot mounted.

WRITE FOR DESCRIPTIVE FOLDER TO DEPT. A.



Reed-Prentice 12-V Miller with Duplicator attachment.

SPECIFICATIONS

CAPACITY

Max. distance Table to face of spindle 18"
Max. distance Spindle to column 26"
Min. distance Spindle to column 12"

SPINDLE

Infinite Speeds 97 to 1730 RPM; arranged for #40 NMTBA taper.
Vertical travel 5"

TABLE

Range:
Longitudinal travel 28"
Cross travel 12"

Feeds: Infinite per Min.
Longitudinal 1/4" to 24"
Cross 1/4" to 24"
Vertical, of ram 1/8" to 16"

Size:
Working surface 12"x 46"
3 T-Slots (spaced 3") 11/16"

MACHINE TOOLS
REED-PRENTICE CORP.
WORCESTER MASS., U.S.A.

NEW YORK OFFICE: 75 West St., New York 6, N. Y.

CLEVELAND OFFICE: 1213 W. 3rd St., Cleveland 13, Ohio

FASTER CUTS

CLEANER CUTS

STRAIGHTER CUTS

assured by the PORTER-McLEOD COLD METAL SAWING MACHINE

Save Time

Save Costs

Valuable time on war work can be saved by the 8" Porter-McLeod high production machine on all classes of work.

Its rating as a truly high production machine is the result of design features which make it possible to nest bars or shapes for multiple cutting, a method of holding the work securely during fast feeds, a unique upward blade movement through stock and a saw design which provides cutting action by every tooth.

These features result in remarkably fast, clean, straight cuts. Sturdy construction and ample power contribute to its ability to handle a standard feed of 3" per minute. Capacity: 8" round or 7½" square stock.

Explore the possibilities of the 8" Porter-McLeod Machine on your high production cold metal sawing operations. *Write today for Descriptive Bulletin.*

PORTER-McLEOD MACHINE TOOL CO., INC.

HATFIELD, MASS., U. S. A.

HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE

Write for Circular!

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.

9025 VAN WYCK AVENUE
JAMAICA, NEW YORK

TELEPHONE: JAMAICA 6-4090

DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1¼ in.

Write for illustrated bulletin.

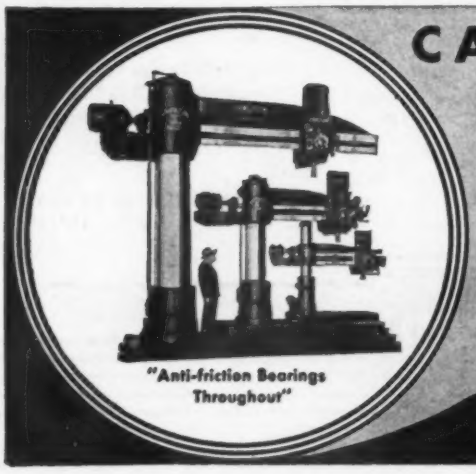
DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT

THE V & O Press Co.

HUDSON, N. Y.

CARLTON RADIAL DRILL



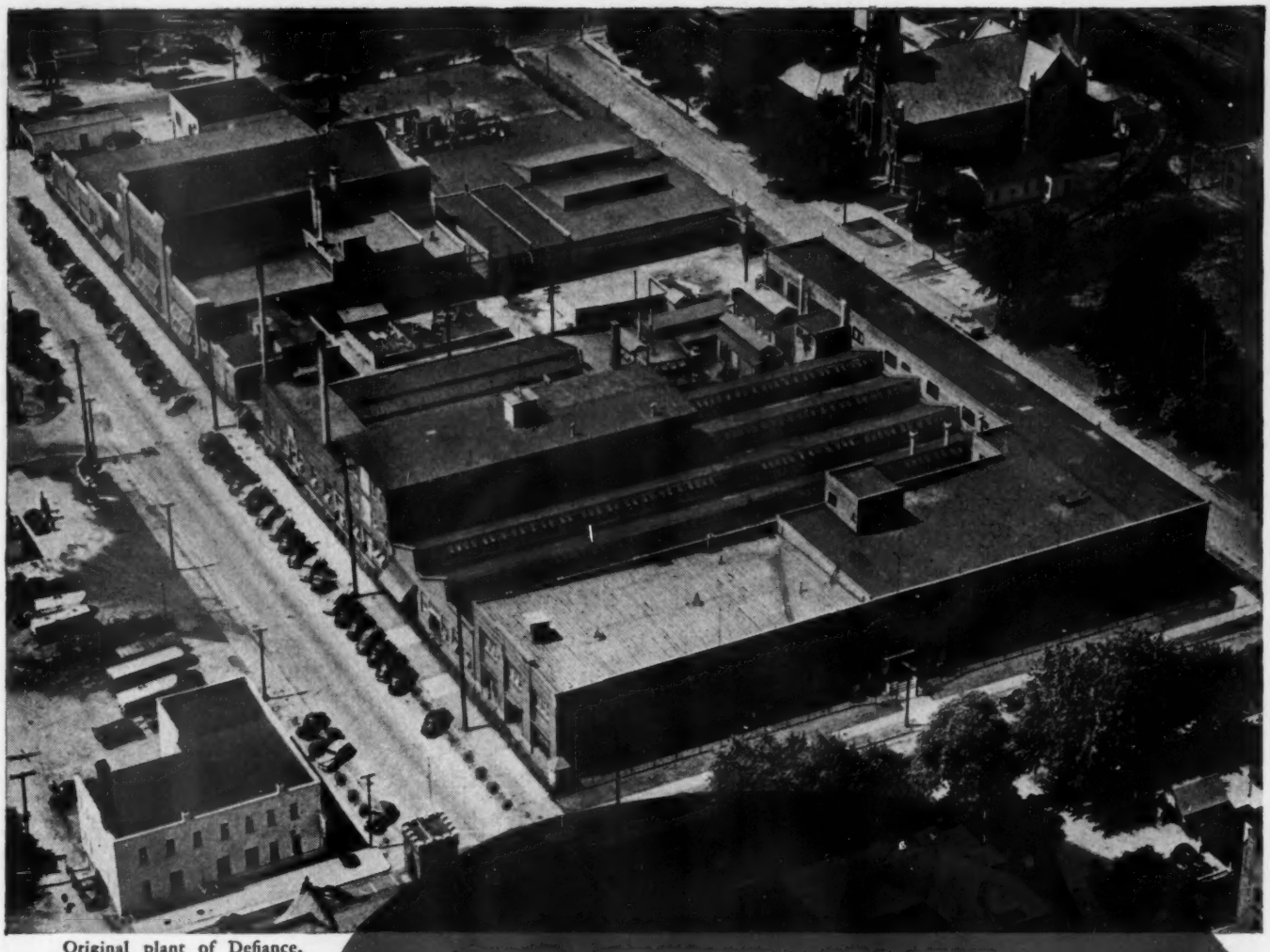
"Anti-friction Bearings Throughout"

FEATURES—1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The CARLTON MACHINE TOOL COMPANY

CINCINNATI, OHIO, U. S. A.

ARMY E NAVY



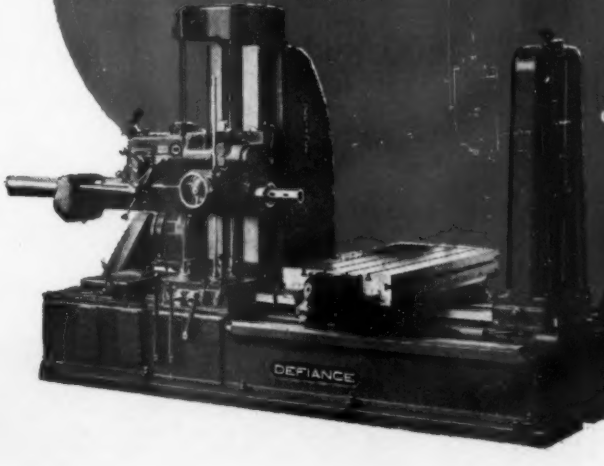
Original plant of Defiance, used in 1850, still stands. It is the small building at lower left of photo. Across the street is the large modern plant for present-day operations.

. . . WHERE PRECISION HAS RULED *for 97 YEARS!*

Way back before Civil War days . . . Defiance built precision machines for wood-turning. These were used to help produce the fine carriages and wagons of that era.

Then came the Age of Metal—and Defiance Engineers turned their talents and experience to developing heavy machines for boring, milling, drilling and tapping.

Today—the entire manufacturing layout and operations at Defiance are planned and tooled for the highest type of *accuracy* and *efficiency*. Defiance Engineering is forward-thinking . . . continuing to pioneer new developments in machines with all the know-how and experience of 97 years. Defiance Machine Works, Inc., Defiance, Ohio.

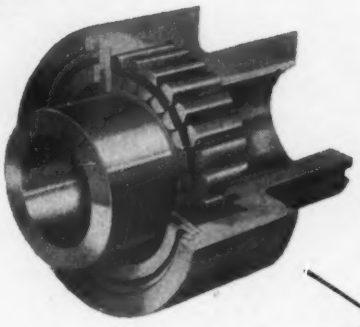


Defiance No. 25A Horizontal Boring Machine is designed with outboard bearing supports allowing maximum cross travel without sag. It has a 3¾" bar . . . 20 speeds range from 12 R. P. M. to 1000 R. P. M. . . . 30" x 60" table. Oversize construction insures rigidity.

DEFIANCE

BORING . . . MILLING . . . DRILLING . . . TAPPING *Machines*

"More Hours of Trouble-Free Service"



FORMSPRAG

THE FULL COMPLEMENT
Over-Running Clutch

PROVED IN SERVICE— IN MANY LINES OF INDUSTRY

● In 1944 Formsprag was being laboratory tested. Now it has stood the test of actual operation under all sorts of conditions. Its design, whereby torque is transmitted through a large number of sprags, with positive, instantaneous engagement and disengagement up to hundreds of times a minute—has proved itself in many lines. Formsprag is enthusiastically endorsed by the manufacturers of bread wrapping machines, box making machines, spring coilers, canning machinery, punch press feeds, textile weaving machines, paper and rubber calendars, printing presses, dual power drives, dry cleaning equipment, machine tools and many other products.

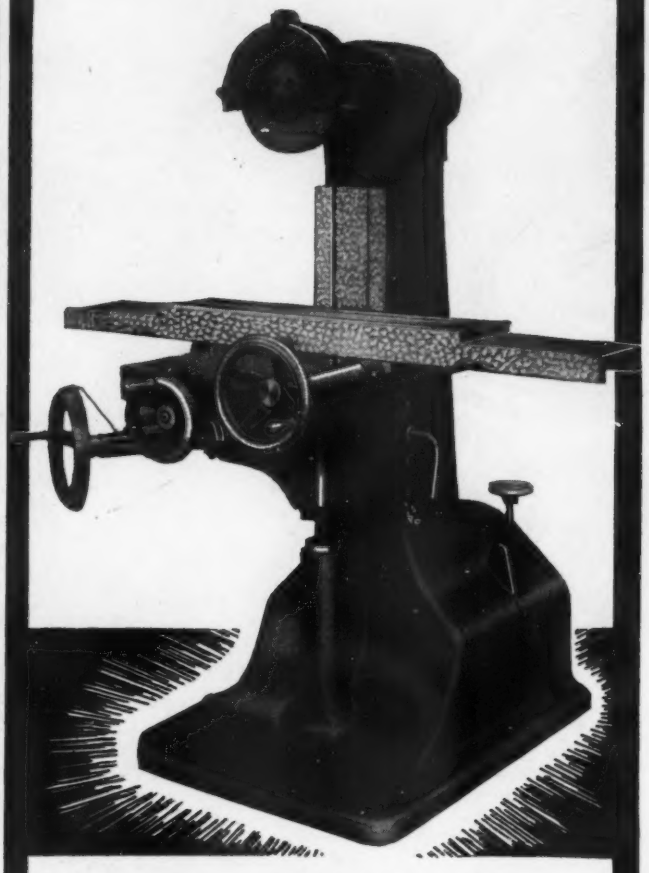
One manufacturer writes, "We are very pleased with this clutch, and regard it as a tremendous improvement. We find that it has no faults, and expect it to give more hours of trouble-free service than the old style clutch."

Write for Illustrated Literature

We can serve you best if you give us a description of your operation, normal and maximum torque at specified speeds, the number of times per minute the clutch engages and disengages, and other pertinent information.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11 MICH U S A

NO. 11 LEACH SURFACE GRINDER



EXTRA LARGE CAPACITY
6" x 24" x 12"
HEIGHT 52"
WEIGHT 850 lbs.
2 SPINDLE SPEEDS
2600 and 3500 R. P. M.

$591.00

Complete with motor of standard Current characteristics F. O. B. Factory.

For further information write Dept. C

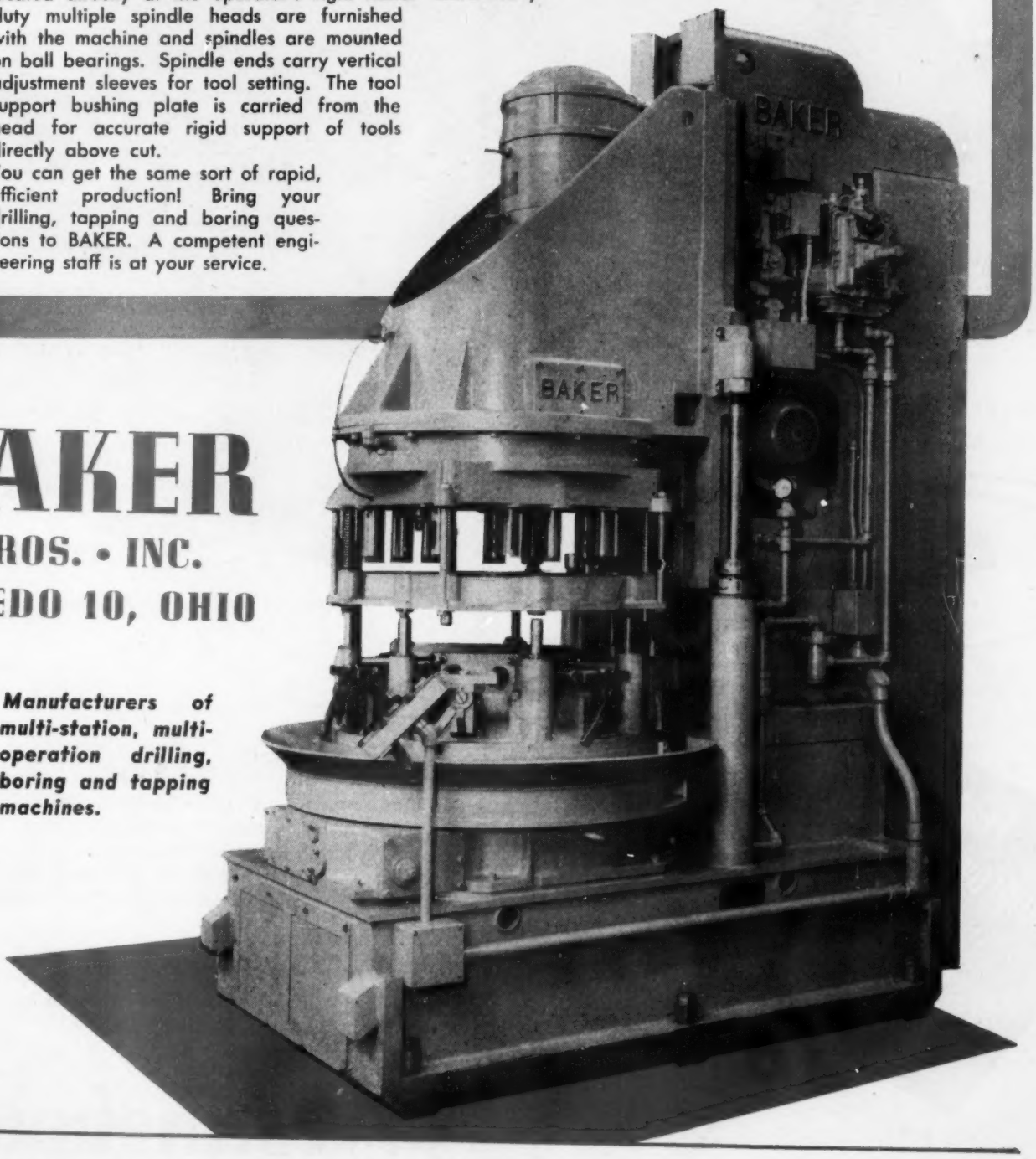
NATIONAL DISTRIBUTORS
H. LEACH MACHINERY CO.
387 CHARLES ST PROVIDENCE 4 R I
AGENTS IN ALL PRINCIPAL CITIES

In the time it takes to read this ad, BAKER's *multi-operation* 60 HO-4

completes six separate operations in automatic cycle!

As an example, to produce six steps in the completion of cast iron shock absorber bodies, all the operator does is load and unload the part. The BAKER 60 HO is equipped with an automatic power index table and an electric cycle control attachment . . . the cycle being started by means of a pushbutton station located directly at the operator's right hand. Extra-heavy-duty multiple spindle heads are furnished with the machine and spindles are mounted on ball bearings. Spindle ends carry vertical adjustment sleeves for tool setting. The tool support bushing plate is carried from the head for accurate rigid support of tools directly above cut.

You can get the same sort of rapid, efficient production! Bring your drilling, tapping and boring questions to BAKER. A competent engineering staff is at your service.



BAKER
BROS. • INC.
TOLEDO 10, OHIO

Manufacturers of multi-station, multi-operation drilling, boring and tapping machines.

The most important advance in motor design in 58 YEARS...

Features and improvements demanded most by users

When Westinghouse engineers began designing a postwar motor they abandoned the concept that all motors must be cousins. Instead, they asked electric motor users *what they wanted* in motors . . . features they couldn't buy in any one motor.

These features demanded most by motor users are *all* incorporated in the new Life-Line Motors:

ALL-STEEL PROTECTION. All frames, fee and brackets are HEAVY STEEL. Life Line Motor stators are far stronger— new core locking device eliminate rivets.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWH

...the New WESTINGHOUSE Life-Line MOTOR

It's completely new . . . it's completely different . . . it wraps up the advances made in "custom-built" wartime motors in a single package!

For 58 years, induction motors have been built fundamentally alike. Differences have been minor . . . improvements gradual. Today, in the new Life-Line, Westinghouse presents a major departure from accepted ideas of standard-motor limitations.

Life-Line, today, offers industry a truly all-steel protected motor. All exposed surfaces are HEAVY STEEL—frames of even the smallest sizes are 3/8" thick.

More compact power is packed in Life-Line. For example, on the 284 frame, size has been reduced 35%, although NEMA mounting dimensions have been maintained . . . starting torques are as much as 134% greater per pound of motor . . . maximum torques as much as 116% more per pound.

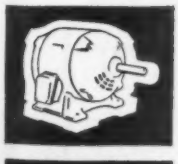
Electrical characteristics have been improved . . . new materials and new winding techniques give increased protection against electrical failure. And sealed, pre-lubricated bearings do away with need for greasing or attention for at least five years!

The Life-Line Motor, as a result, represents the biggest single step forward in design and construction since the invention of the electric motor 58 years ago. Life-Line Motors are now reaching the drives of industry by the thousands, but are not yet available in quantities to meet the unprecedented demand. So, look over Life-Line advantages now with an eye to your future requirements. Your local Westinghouse office can give you full details, or write to Westinghouse Electric Corporation, P. O. Box 2025, Buffalo 5, N. Y.

★ ★ ★

Life-Line Motors are now in production at the new Westinghouse Motor Works in Buffalo, N. Y. This plant is laid out, tooled and equipped to fully utilize newly developed production processes and techniques on a scale hitherto unequalled in the manufacture of electrical motors.

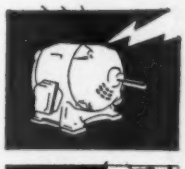
J-21406



LESS SPACE PER HP. Life-Line Motors occupy less space per horsepower than any other standard motor . . . making it easier to build into machines and install in cramped quarters.

MORE TORQUE PER LB. Life-Line Motors give as much as 134% higher starting torque per pound of motor . . . up to 116% higher maximum torque.

NO LUBRICATION FOR 5 YEARS. Life-Line Motors need no greasing for AT LEAST FIVE YEARS. Bearings are pre-lubricated . . . sealed against dirt and moisture.



IMPROVED WINDINGS. New insulating materials . . . new coil winding techniques . . . new stator slot designs . . . give the Life-Line new record-setting protection against electrical failures.

NEW QUIET SMOOTHNESS. Life-Line Motors cut vibration and noise to new low limits for standard motors . . . satisfy many "special motor" requirements.

NEW SLEEK LINES. The Life-Line has sleek lines . . . a smooth finish . . . discourages dust and dirt accumulations . . . harmonizes with modern machine and tool design.

Life-Line motors

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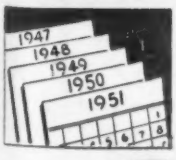

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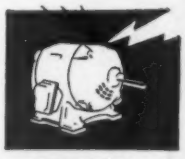

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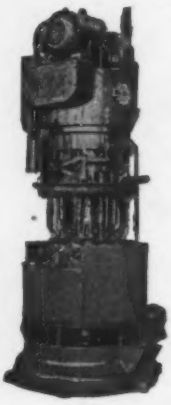
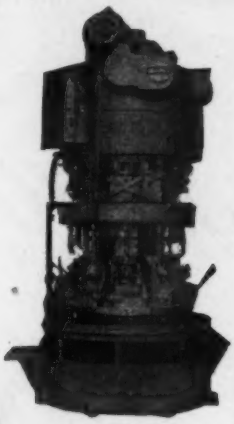
Life-Line motors

TWO TOUGH AUTOMOTIVE JOBS

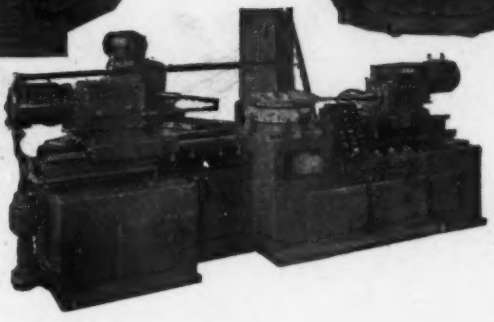


Roto-Matic Drilling MACHINES

VERTICAL AND HORIZONTAL TYPES



MULTIPLE SPINDLES



Highest Production — Low Maintenance

MILLING • DRILLING • REAMING • BORING • PIPE THREADING • SPECIAL MACHINES

DAVIS & THOMPSON COMPANY

MANUFACTURERS: MACHINE TOOLS, MICROMETERS AND GAGES

MILWAUKEE WISCONSIN

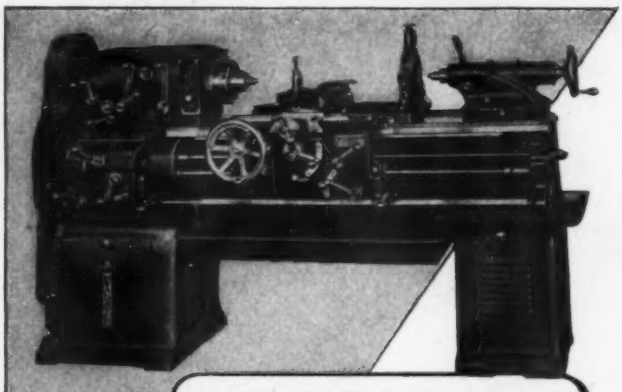
tops in the tool room

Save three ways with Grand Rapids No. 10-B Combination Tap and Drill Grinder: 1. Lower first cost; 2. Less maintenance expense; 3. Valuable floor space.

Write for Bulletin 9-15-44

Grand Rapids 10-B Combination Tap and Drill Grinder

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.



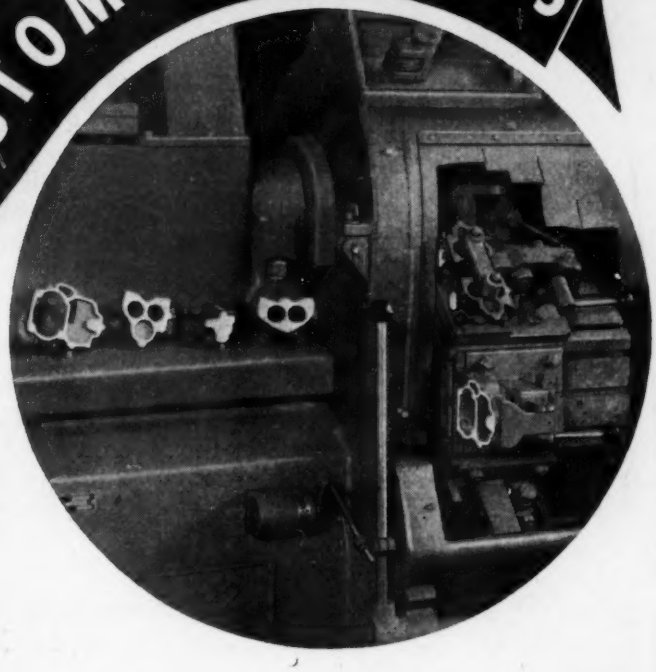
BRADFORD METALMASTER *does it faster*

Compare BRADFORD'S performance. You'll discover that for speed, accuracy BRADFORD ranks — first. Precision constructed the BRADFORD Metalmaster is designed for your wartime and peacetime jobs. Write for catalogs describing the advantages of this lathe.

The BRADFORD MACHINE TOOL CO.

1840—1945 CINCINNATI, OHIO

TWO TOUGH AUTOMOTIVE JOBS

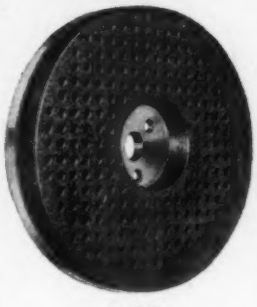


Handled on GARDNER GRINDERS

THE AUTOMOTIVE industry uses GARDNER-GRINDING to speed up production and maintain necessary accuracies on many types, shapes, sizes of parts.

In the top illustration, a No. 120A-26" GARDNER Double Spindle GRINDER with rotary work carrier, flat-surfaces TWO ends of valve tappets at ONE setting, at the rate of 25 parts per minute. ACCURACIES are held to .005" for uniformity and .0015" for squareness with the O.D. STOCK REMOVAL is .010" on the chilled end and .040" on the soft end.

GARDNER WIRE-LOKT ABRASIVES



ARE *Modern* CUTTING MEMBERS

In the lower illustration, a No. 122-20" semi-automatic GARDNER-GRINDER grinds 4 faces of carburetor bodies. Parts are loaded by hand to automatic clamping and unclamping fixtures carried on an 8-sided revolving drum. PRODUCTION is at the rate of 6 to 10 surfaces per minute. ACCURACIES are held to .002" to .004" for flatness; .004" to .006" for parallelism; and .004" to .006" for uniformity. STOCK REMOVAL is up to .030" maximum on the body, plus draft (not to exceed .050" total).

Write for data on GARDNER-GRINDING!

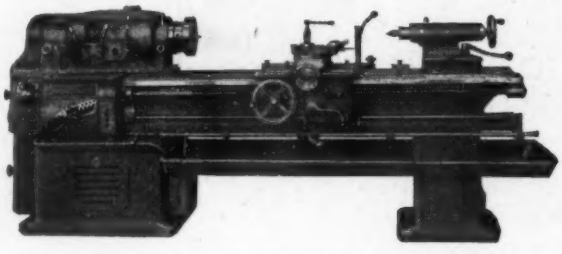
GARDNER-GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

THE PRECIOUS INTANGIBLE . . .

THE Precious Intangible—precision—can never be completely judged until a machine has been thoroughly tried. But to be certain you'll have the precious intangible in the machines you buy, you will do well to look for tangible evidence of performance. Hendey, since 1870, has built machines to the highest standards of precision workmanship—and tangible evidence that they have the "precious intangible" fills our letter files. That is why we confidently suggest you compare the production and precision of a Hendey with any other similar machine on the market.



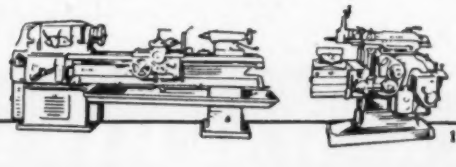
Hendey 18 speed Precision Tool room Lathe
Complete details may be had on request.

The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Branch Offices — New York, Chicago, Boston, Detroit, and Rochester
Representatives in — Phila., Cleveland. Los Angeles, Pittsburgh, San Francisco



TOOL ROOM LATHES
12"-16"-18"

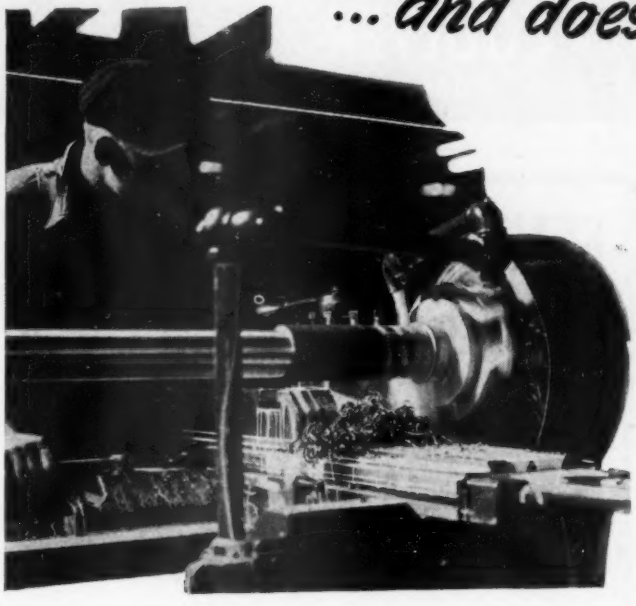
SHAPERS
12"-16"-20"-24"-28"

Tycol

650 SERIES

DUAL-PURPOSE OIL FOR CUTTING AND LUBRICATION

"Does the work of Two Oils ... and does it BETTER!"



"Increases speed..."
"Prolongs tool life..."
"Eliminates corrosion, tarnish..."
"Slashes maintenance costs..."
"Protects bearings and gears..."

Yes . . . operators and lubrication engineers agree that Tycol 650 Series Dual-Purpose Oil is the *one* oil for both cutting and machine lubrication that gives better results *both* ways.

Get in touch with your nearest Tide Water Associated Office today for full details.

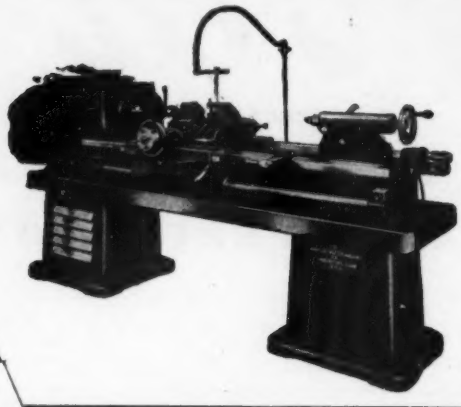
LUBRICATION—"ENGINEERED TO FIT THE JOB"

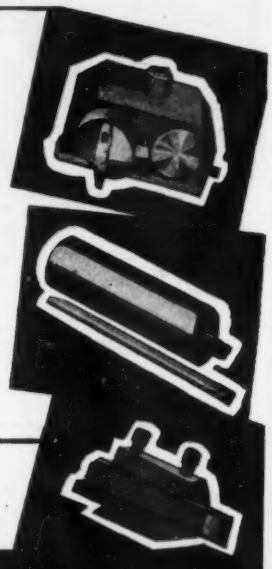
TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

40 YEARS OF EXPERIENCE produced
THE NEW COULTER
AUTOMATIC THREADING LATHE





The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

Equipped with disc clutch. . . . Easy to operate. . . . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.

PRODUCTION MACHINES SINCE 1896
Write for full particulars

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

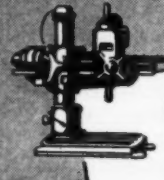
This IS THE HAMILTON
SENSITIVE TAPPING MACHINE

—especially engineered for the sensitive, accurate, **production** tapping of small holes. **Capacity**—From the smallest and finest tap to 10-32 inclusive. **Chuck**—Special Jacobs A1 0-1/4 in. **Power**—1/8 H. P. **Speeds**—Approx. 1200-2600 R.P.M. **Size**—16" x 7" x 22". **Weight**—Approx. 75 lbs. Ample travel and clearances for all work within its range. Write for literature and prices. Address Dept. D-T.

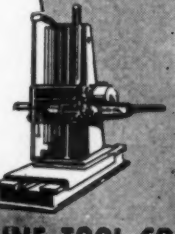
THE *Hamilton* TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTALVATORS
NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A

GEAR CUTTING MACHINES
New Design
New Features
New Advantages
NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK 5, NEW JERSEY
FRANK E. EBERHARDT, *President*

GILBERT



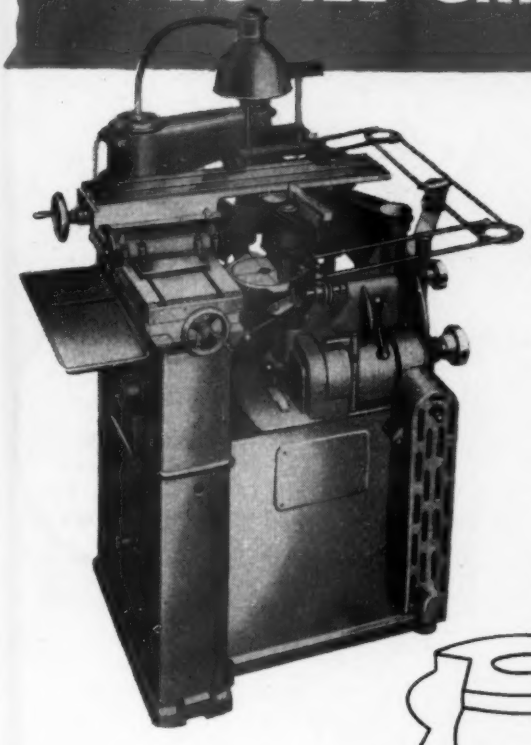
PRODUCTION SPEEDING
RADIAL DRILLS
AND
HORIZONTAL
DRILLING, BORING
AND MILLING
MACHINES

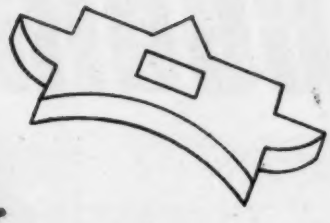


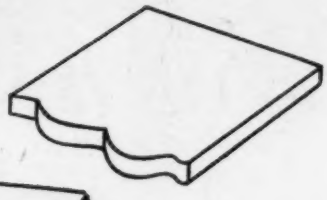
DETAILS ON REQUEST

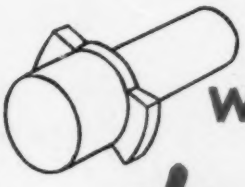
THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

Fast PROFILE GRINDING

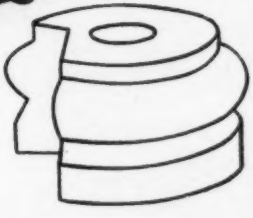


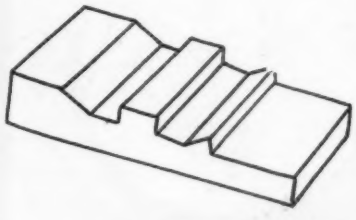






WITHIN LIMITS OF ±0.0002"





Now you can perform intricate profile grinding at practical high speeds and to exceptional degrees of accuracy! With the Studer Profile Grinding Machine Type PSM you can attain accuracy to within ±0.0002" in producing profile gages, straight or circular form tools, sectional dies, complete contours like cams, templates and similar parts of hardened steel. Profiles up to 5.9" in length can be ground from end to end in one continuous operation without moving work-piece or template. Circular work up to 4" in diameter can be ground, and flat pieces—several of which can be stacked for grinding at one time—can be handled up to 2" in thickness. Small sized profiles can be accurately produced without preliminary grinding to form, and clearance angles on parts such as form tools can be ground without removing the work from its original setting.

These are the highlight features of the Studer Profile Grinder. If you can use its exceptional accuracy, its speed and ease of operation, its amazing versatility, write for complete information.

We also represent in the United States these other makers of Swiss High Precision Equipment: Societe Genevoise d'Instruments de Physique (SIP), Andre Bechter, Mikron, Safag, Sallaz, Schaublein, Leinhard. Our engineers will be glad to work with you in specifying and using equipment for the highest precision machining.

THE STUDER PROFILE GRINDER

The Studer principle employs a tracer finger which follows the form of a template and transmits its movements to the grinding wheel through a pantograph. The wheel and stylus can be swiveled. Because the wheel is shaped beforehand proportionately to the exact shape of the tracer finger, an object can be ground over its entire length in one operation—with one wheel. Because a fixed template is used, errors due to incorrect manipulation are eliminated. A special template holder permits the grinding of circular forms of contours like cams over their entire circumference.

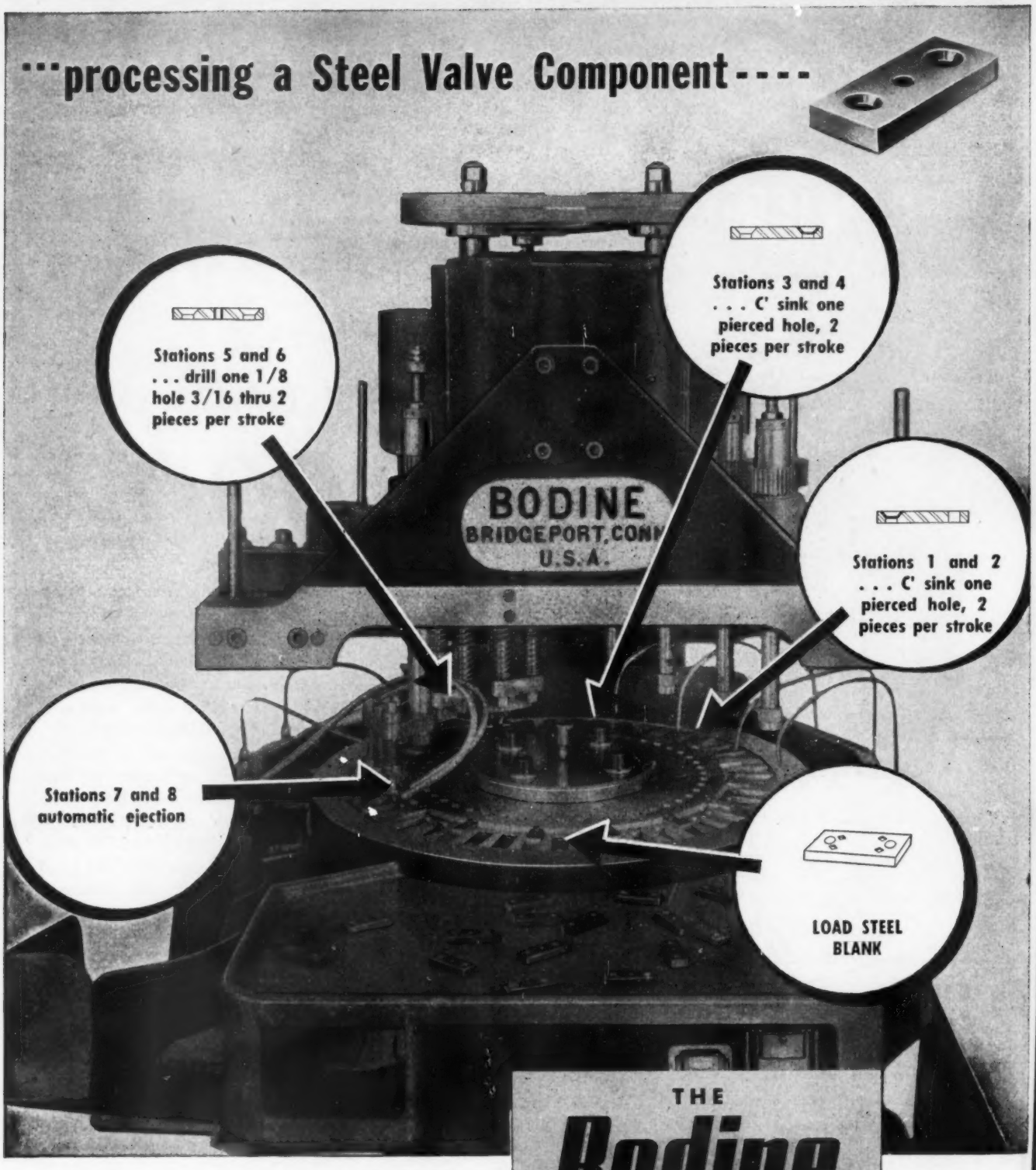
HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

Bodine..Case History No. 17


...processing a Steel Valve Component----
Stations 5 and 6 . . . drill one 1/8 hole 3/16 thru 2 pieces per stroke
Stations 3 and 4 . . . C' sink one pierced hole, 2 pieces per stroke
Stations 1 and 2 . . . C' sink one pierced hole, 2 pieces per stroke
Stations 7 and 8 automatic ejection
LOAD STEEL BLANK
BODINE
BRIDGEPORT, CONN
U.S.A.

• Production 1800 pieces per 50 minute hour...2 pieces per stroke on this Bodine 6 spindle Drilling Machine. Bulletin on request.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Bridgeport

TURRET MILLING MACHINE

SPECIFICATIONS

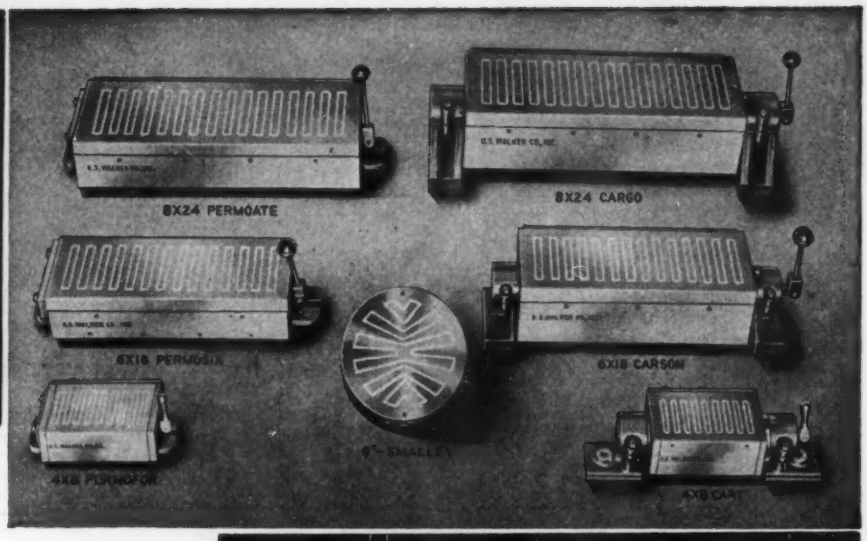
Longitudinal Feed . . . 20"
Cross Feed . . . 9"
Vertical Feed of Knee . . . 16"
Standard Table . . . 9"x32"
Special Tables up to 48" available; also longitudinal power feed
Weight with Shaping Unit . . . 2000 lbs.

Investigate today

This modern streamlined machine makes it possible to reduce idle time to a minimum because at one set up it will mill, bore, drill and shape *at all angles of the work*. Convenient handling of all of these operations is a further means of speeding up production and of making every minute count. The time- and effort-saving advantages of the "Bridgeport" are such as to recommend it for replacing those obsolete machines which are more of a liability than an asset today in many shops. Why not explore the possibilities of the "Bridgeport" NOW.

Bridgeport* MACHINES, Inc. *Bridgeport, Conn.

Walker Chucks



Truly a credit to the O. S. Walker Co., Inc.

Over 60 years of chuck building, design, and engineering experience is incorporated into these PERMOS.

WALKER ENGINEERS invite you to present your problems for solution at no obligation.

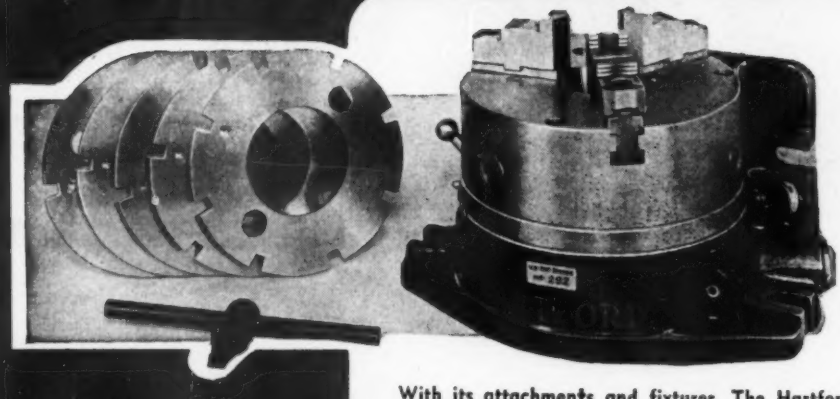
REMEMBER there is a WALKER CHUCK for every known application.

O. S. WALKER CO., INC.

Original Designers and Builders of Magnetic Chucks

Worcester 6, Mass.

This is the WALKER PERMANENT CHUCK FAMILY



. . . a practical, proved means of handling Indexing on a wide range of operations . . .

With its attachments and fixtures, The Hartford Super-Spacer can be depended on as a time-saving spacing device for milling, drilling, jig boring, planing, slotting and grinding. Many jobs are being handled today with the Super-Spacer at faster speeds and with greater accuracy than they have ever been handled before.

All this points to the advisability of exploring the possibilities of the Super-Spacer on your work. The many new problems that have been solved through the use of the Hartford Super-Spacer suggest the importance of looking carefully into your methods of handling indexing. Our engineers have a vast accumulation of experience on which to draw and can be of invaluable assistance to you in appraising your requirements and rendering helpful service.

The latest information on the Hartford Super-Spacer is contained in a fully illustrated booklet sent promptly on request. Ask for your copy TODAY.

The **HARTFORD SUPER-SPACER**

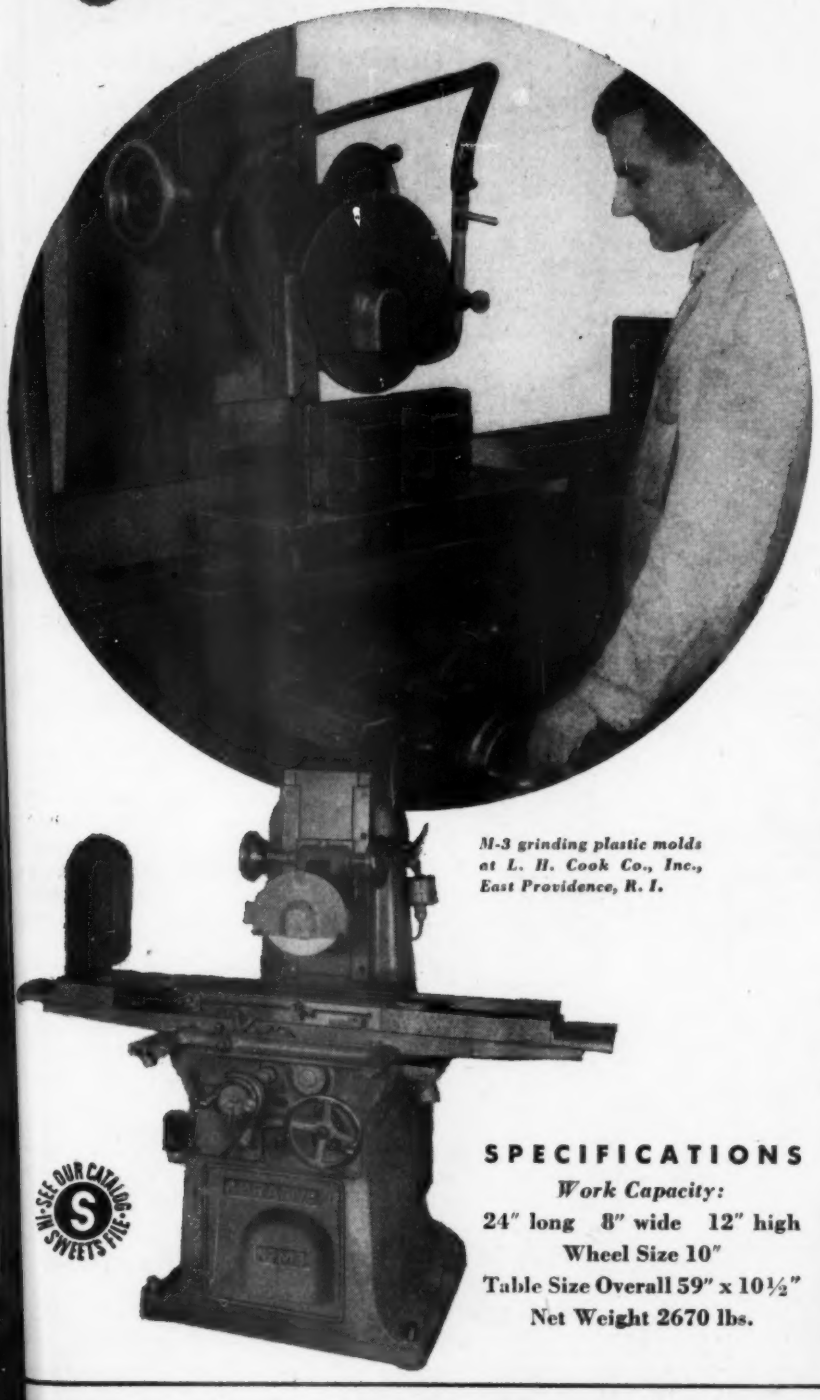
The **HARTFORD SPECIAL MACHINERY CO.**

HARTFORD 5, CONN.

Plastic Mold Makers

OK ABRASIVE M-3

MOTORIZED SPINDLE SURFACE GRINDER



M-3 grinding plastic molds at L. H. Cook Co., Inc., East Providence, R. I.

. . . *for* SPEED, ACCURACY AND VERSATILITY . . .

Extreme accuracy and fast production make the ABRASIVE M-3 a favorite with manufacturers of plastic molds. The dynamically balanced rotor, mounted directly on the grinding wheel spindle, gives unusually high finishes and delivers maximum power at the cutting point — without the use of belts, chains, or sprockets. ABRASIVE design includes fast automatic feeds and built-in shock absorber to cushion shock of table reversal. Vertical feed dial is accurately graduated to .0001″ for work to close limits. The massive one-piece bed casting minimizes vibration and insures perfect alignment and long machine life. In the toolroom and on the production line the No. M-3 is a top performer.

Write for information

★

For information regarding Abrasive Machines on the Government Surplus Tool List, send us serial number of the machine. We will endeavor to provide attachments, accessories and repair parts as desired.

SEE OUR CATALOG IN SWEET'S FILE

SPECIFICATIONS

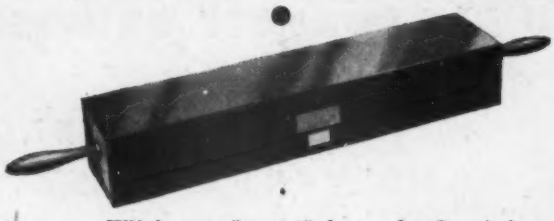
Work Capacity:
24″ long 8″ wide 12″ high
Wheel Size 10″
Table Size Overall 59″ x 10½″
Net Weight 2670 lbs.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE MACHINE TOOL CO., East Providence 14, Rhode Island

New VELSEY BLACK GRANITE STRAIGHT PLANE

FOR HIGH-SPOTTING LARGE AREAS



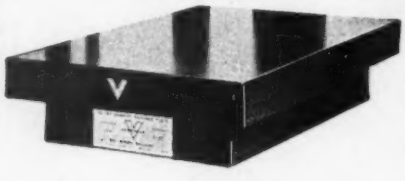
With an 8" x 36" face, the Straight Plane gives lateral as well as linear coverage for high-spotting surfaces to be ground or scraped.

Suppose, for example, you are scraping a machine bed 12 feet long. You high-spot the middle section with the Straight Plane. After it is trued up, you lay about half of the Plane on the scraped surface and half on the adjoining area, working thus toward both ends of the bed. At the finish, you can have flatness over the whole area to a tolerance of .0001" or less, both lengthwise and crosswise.

The bearing face of the Straight Plane has a flatness accuracy of .000025". No distortion can occur from molecular strain, temperature, or jarring. The Plane is non-corrosive, non-magnetic, impervious, impenetrable. Knocks do not cause burrs or bulges. Weight is approximately 200 lbs. Handles are removable.

The Straight Plane was suggested by metalworkers who have been using Velsey Surface Plates for high-spotting.

VELSEY BLACK GRANITE SURFACE PLATES

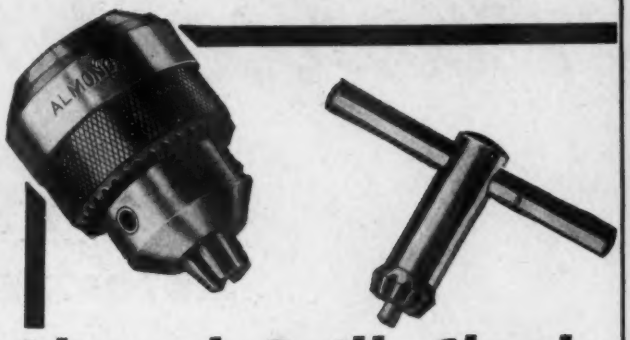


Black Granite is the commercial name of *Olivine Diabase*, an igneous rock similar to basalt. It is nearly as hard as diamond; 15% heavier than true granite; 1/30th as absorptive.

Due to the hardness and density of *Olivine Diabase*, Velsey Surface Plates last indefinitely with ordinary care. Master Series plates are finished to .00005" surface accuracy; Standard Series to .0001". Stock sizes are 12" x 18", 18" x 24", 24" x 36". Special sizes are made to order.

Ask for complete information about Velsey Straight Planes and Surface Plates.

EAST SHORE MACH. PROD. CO.
DEPT. 1, 835 E. 140TH STREET
CLEVELAND 10, OHIO



Almond Drill Chuck

THE FIRST IN THE FIELD

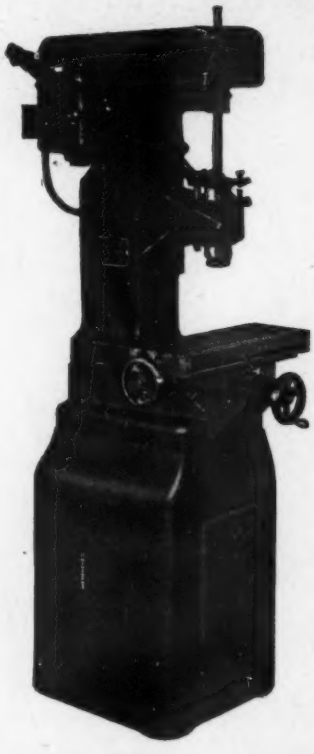
ALMOND THREE-JAW DRILL CHUCKS were the first to be placed on the market over Seventy years ago. As Pioneers in the field of Drill Chucks, the name "ALMOND" has long been associated with the logical procedure of machine developments. ALMOND DRILL CHUCKS are made in types and sizes to fit all machine tools and portable drills.

Complete information is available on request.

The Original Manufacturers of Drill Chucks

T. R. ALMOND MFG. CO.
Ashburnham, Mass., U.S.A.

THE LINLEY...



FAST, ACCURATE
EXTREMELY VERSATILE

Linley has designed and built this Milling and Jig Boring machine expressly for fast and accurate toolroom work. It is compact, rigid and easy to operate, change-overs being quickly made to accommodate the making of small dies, jigs, fixtures, patterns and models.

It will unscramble congested schedules and keep your larger machines for their higher rated capacities. Toolmakers' valuable time is saved, profits earned. Eight spindle speeds to 4250 r.p.m., velvet feed, no backlash in quill travel. Has ample (7"x17½") table size. Needs only 2½ sq. ft. of floor space.

SEE DETAILED BULLETIN

LINLEY BROTHERS COMPANY
664 STATE ST. EXTENSION
BRIDGEPORT 1, CONNECTICUT

WANTED

problems in

DRILLING
REAMING
TAPPING
THREADING
MILLING

WE welcome your problems here—if they have to do with reducing costs or increasing production in drilling, reaming, tapping, threading or milling metal or plastics.

Specifying the right tools to meet these problems with economy and efficiency is as much a part of our business as is the manufacture of the tools themselves in our modern factory, where the most modern equipment and methods are in use.

Our 65 years of continuously successful experience in making drills, reamers, taps, dies and milling cutters for America's mass production industries—Farm Implement, Railway, Electrical, Automotive, Home Appliance, and Aviation—is applied to your problem without cost or obligation.

Our Mill Supply Distributors, coast to coast, give this service either direct or through our factory representatives.

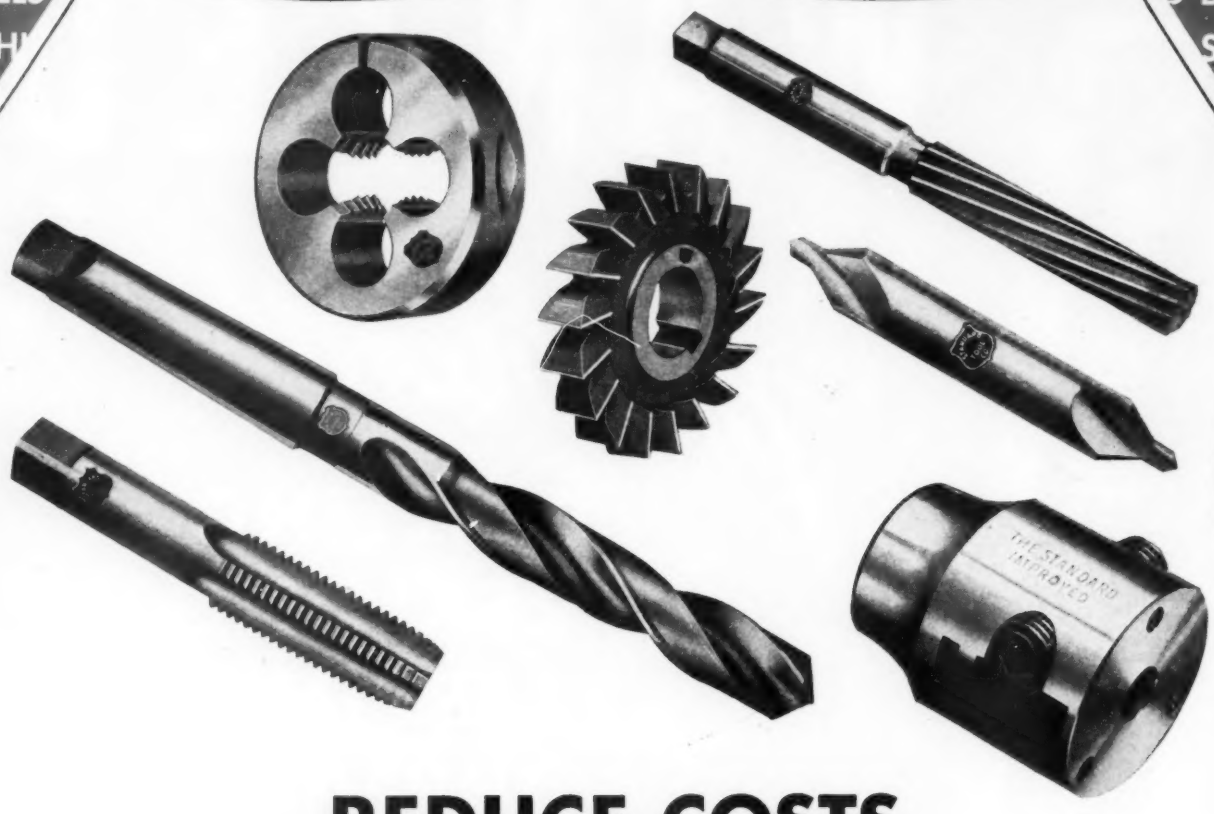
There is no substitute for experience. Send us your problems today.

STANDARD TOOL CO.

THE STANDARD TOOL CO.

CLEVELAND

Warehouses: New York • Detroit • Chicago



REDUCE COSTS
without INCREASED INVESTMENT

SUGGESTIONS for reducing costs usually require an increase in capital investment.

Here is one that doesn't.

Standardize metal cutting tools by specifying Standard Shield Brand Drills, Reamers, Taps, Dies, Milling Cutters.

Time will be saved with resulting reduced costs in—

1. Purchasing Department
2. Stockroom
3. Tool crib
4. Machine shop, by the uniform performance of these tools.

With factory warehouses in principal centers, our leading Mill Supply Distributors, coast to coast, should provide prompt, adequate service on wanted tools.

You can start making these savings today—call your Mill Supply Distributor, or write . . .

THE STANDARD TOOL CO.

CLEVELAND

Warehouses: New York · Detroit · Chicago

A LONGER run for your money!

It's easy to prove! Use a few tools with Improved TECO Cemented Carbide—on *any* carbide job. Run under identical conditions. Then check production and job-tooling cost against your present carbides. You will discover that improved TECO can be operated at higher speeds and feeds—gives more pieces per grind—more grinds per tool—longer tool life—and much lower tool costs.

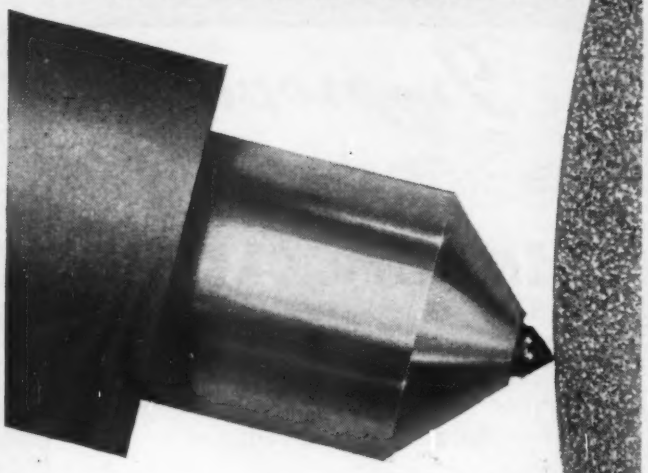
The reason is found in our advanced metallurgical techniques, closely guarded by more rigid control methods at every step in manufacture. Result—an *improved* TECO Cemented Carbide — harder, tougher, more uniform in structure—more resistant to wear and breakage.

At your request, a TECO tool engineer will demonstrate. Or send us details of your set-up for proper recommendation. Write for latest catalog and price list.

TUNGSTEN ELECTRIC CORPORATION
568 39th Street, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

Improved
TECO
CEMENTED CARBIDE

For Utmost Precision...



...use Desmond Diamond Tools

THE PLAIN FACT that Desmond makes the only complete line of grinding wheel dressing and truing tools is reason enough for specifying Desmond for all your dressing requirements. But there are other good reasons, too. Take diamond tools. We select rough diamonds with expert care, mount them (in hand tools or nibs) with hard-earned know-how, and *stand behind every single one.*

Fasten your Desmond diamond tools securely in the tool post or holder . . . with the tool axis at an angle of 10 to 15 degrees with respect to the radius . . . and turn the tool frequently to present a new diamond point. As a rule large diamonds run cooler and *do more work per dollar* than small ones.

Write for your copy of the Desmond Catalog No. 45 today. It will help you pick the right tool for the job—and get the most out of it.

THE DESMOND-STEPHAN MFG. CO., URBANA, OHIO

Desmond

the only complete line of grinding wheel

DRESSERS & CUTTERS

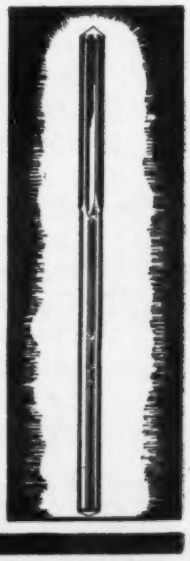
BALL BEARING DRESSERS · REVOLVING CUTTER TYPE DRESSERS · DIAMOND HAND TOOLS AND NIBS · WHEEL TYPE DRESSERS · SIMPLEX STEEL-SLIDE VISES

IT COSTS MONEY TO GUESS WRONG

. . . a fact that can be especially true when it comes to selecting the raw materials or special machinery — *or reamers* — used in manufacturing your products.

But there's never any need to guess whether the *reamers* you buy can handle the job with the kind of efficiency you want when you specify L & I Ground Flute Reamers. They've *got* to be good because they're made from solid, high-speed bar steel that's uniformly hardened and treated *before the flutes are ground* (not milled). As a result you get reamers with true-line, longer-lasting, keener-cutting edges that are free from burrs and saw-teeth.

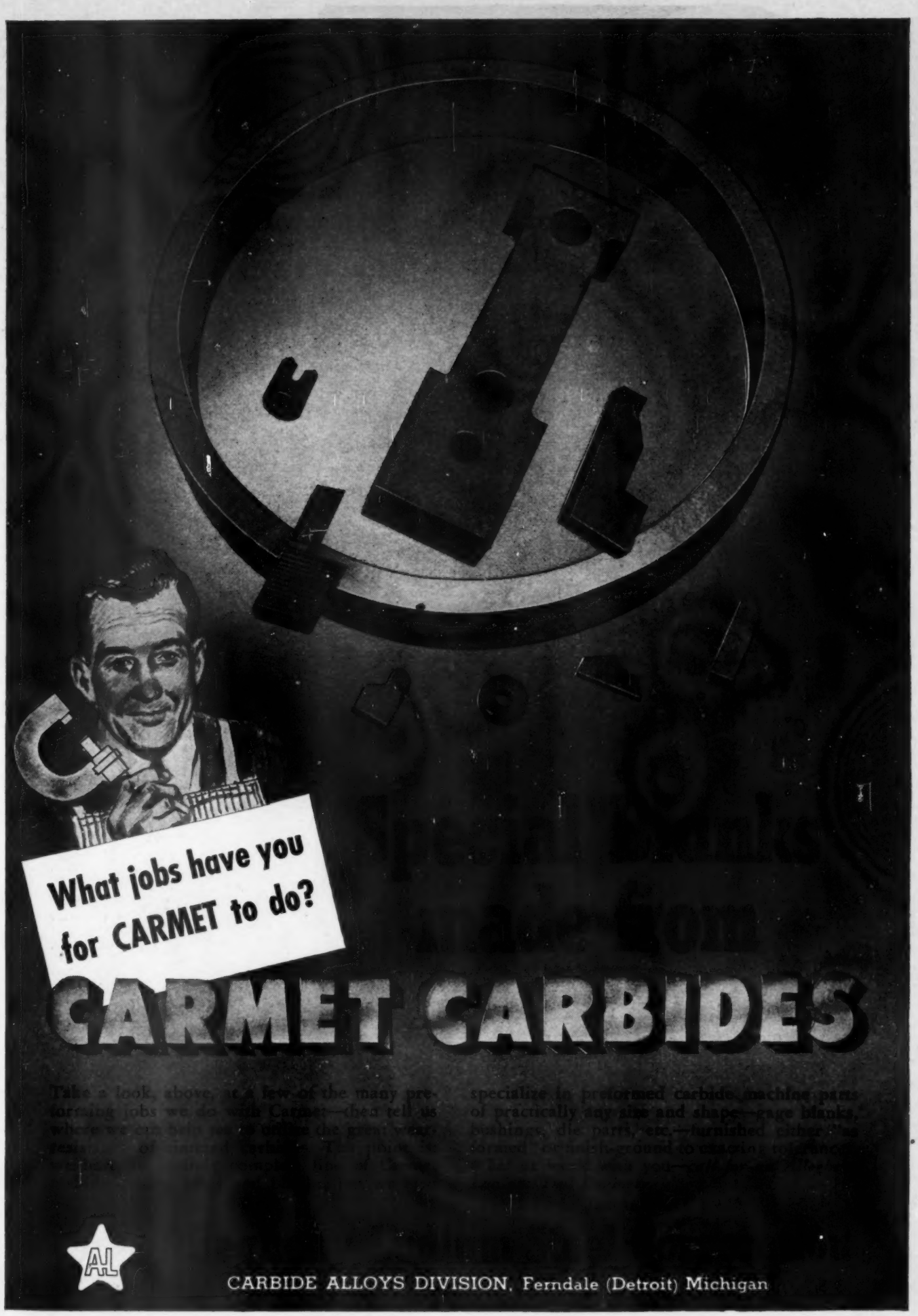
And you won't have to guess at the production life of L & I Reamers, either. For wherever they're used the answer's usually the same: greater production life per reamer, as well as better, faster work.



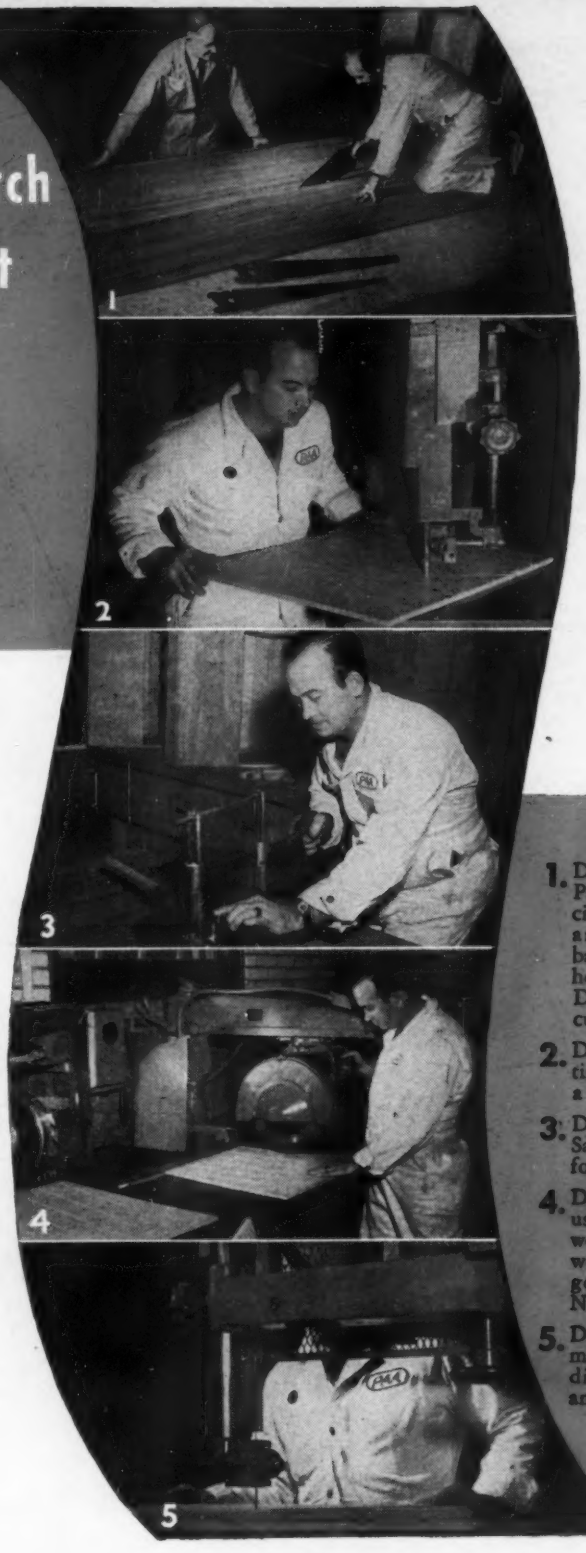
Write today for descriptive catalogs giving prices and sizes. L & I Ground-from-the Solid Reamers are available in any quantity for immediate delivery. Stock sizes from .040″ to .3125″ diameter. Specials in any size.

LAVALLEE & IDE, INC.
Chicopee • Mass.

L&I GROUND FLUTE REAMERS


What jobs have you for CARMET to do?
CARMET CARBIDES
CARBIDE ALLOYS DIVISION, Ferndale (Detroit) Michigan

How Disstoneer* research and development "cut costs and save time" for Pan American World Airways



1. Disston Saws used by Pan American include circular saws, cross-cut and rip handsaws, back saws and key-hole saws. There's a Disston saw for every cutting need.
2. Disston Band Saw cutting wood template for a dural metal fitting.
3. Disston Mitre Box Saw cutting molding for cabinets.
4. Disston Dado being used to rabbet plywood panels—difficult work because of danger of splintering. Note clean, sharp cuts.
5. Disston Band Saws of many sizes are used for different operations and types of wood.

In the carpenter shops of Pan American Airways, practically every type of wood-cutting saw used by industry is busy at work on equipment for their giant Atlantic and Pacific Clippers. These saws are Disston Saws . . . developed by years of research and a thorough understanding of industry's cutting-tool requirements.

A Pan American official writes: "Actually the pictures portray a better story of our dependence upon Disston equipment to cut costs and save time than I could convey with many words. Also, what we have here pictured is nothing more than is to be found at many of our *world-wide* bases where Disston products play a vital part in our operations."

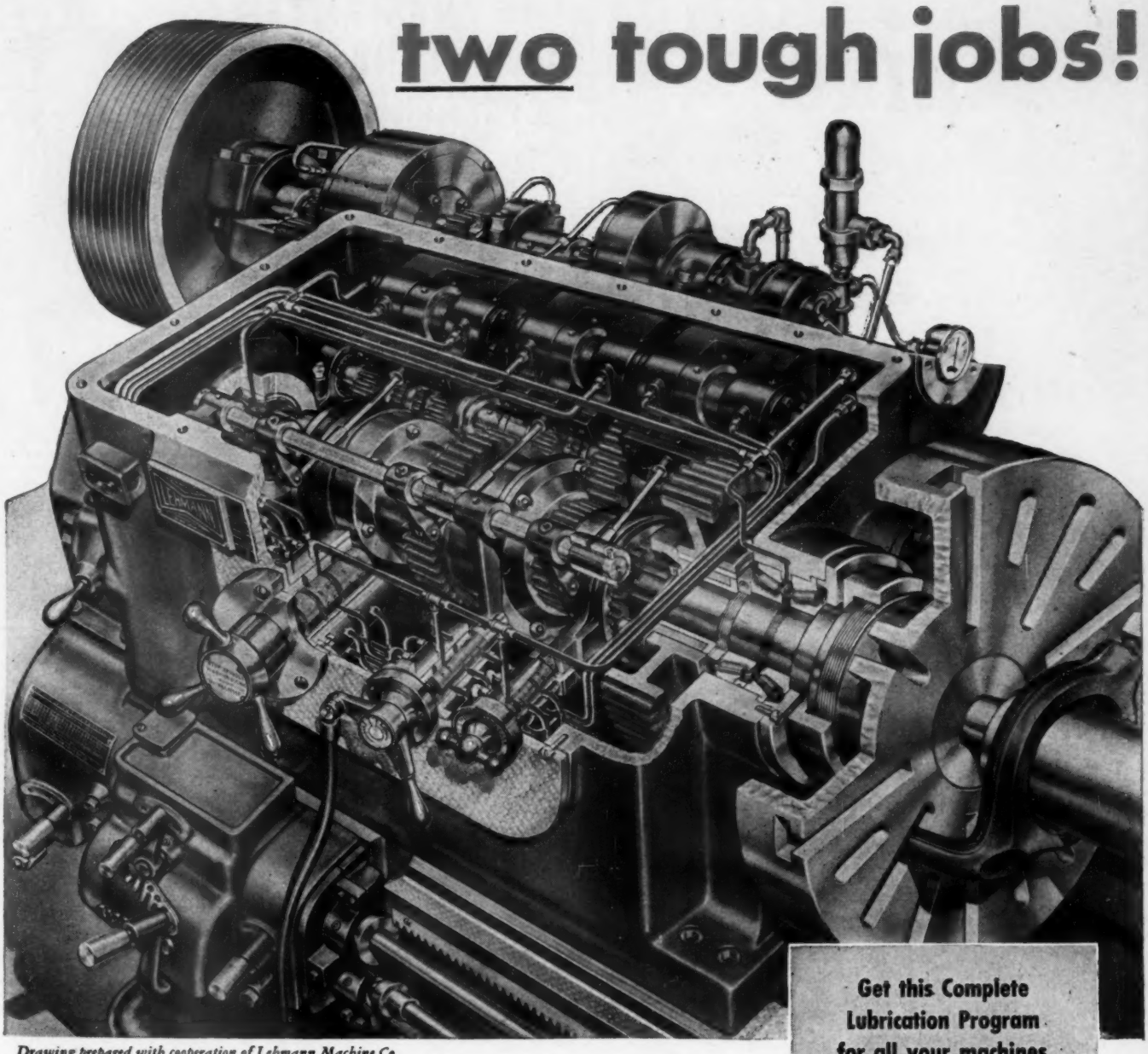
***DISSTONEER**—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut wood, metal, or other materials—and TO CUT YOUR COST OF PRODUCTION, not only on special work, but on ordinary jobs as well.

STEEL . . . Everybody who wants to obtain steel can help himself to get it by immediately starting scrap into the channels that serve steel mills.

HENRY DISSTON & SONS, INC., 1220 Tacony, Philadelphia 35, Pa., U. S. A.

P. O. 29701

Here one oil does two tough jobs!



Drawing prepared with cooperation of Lehmann Machine Co.

THIS ingenious variable-speed lathe poses a double problem for oil. For the same oil serves as both a hydraulic medium for the sensitive controls and as a lubricant for all headstock gears and bearings.

Both of these jobs require an oil with high chemical stability. Inside the hydraulic system, the oil must resist formation of deposits that clog lines, valves and clutch and brake mechanisms. On the gears and bearings it must fight off oxidation, due to continuous splashing and churning in the presence of air. Also, it must maintain strong films to minimize wear.

Many machine tool manufacturers now recommend Gargoyle Vacuoline Oil because of its high stability in double-duty service of this nature. It helps maintain the accuracy of the machine and reduces wear over long periods of continuous service. Ask your Socony-Vacuum Representative for facts.

Get this Complete Lubrication Program for all your machines

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

GARGOYLE Lubricants

Socony-Vacuum Oil Co., Inc.

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TUNE IN THE MOBILGAS PROGRAM—MONDAY EVENINGS, 9:30 E.S.T.—N.B.C.

Delicate, precision parts, whether they be round, flat or contoured, marked so that mirror-fine surfaces are not marred or distorted—that's Matthews "*AIRGRIT* Machine". Its process—a short, uniform blast of fine grit through rubber or celluloid masks against the area to be marked.

The *AIRGRIT* Machine is versatile in range of uses—designs, trademarks and special lettering in sizes as small as .055" in height can be marked legibly and uniformly in an area as large as 4" x 3". The machine is proving revolutionary in the marking of cutlery, bearings, glass, airplane parts, plastics, porcelain, optical instruments, tool bits and fibre parts.

Remember

A Product Worth Marking
Is Worth Marking Well

Write For The Airgrit Bulletin

JAS. H. MATTHEWS & CO.

3956 FORBES STREET PITTSBURGH 13, PA.

BRANCH PLANTS
NEW YORK, BOSTON, CHICAGO, PHILADELPHIA, NEWARK, SYRACUSE
District Sales Offices: Cleveland, Cincinnati, Birmingham

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

WRITE today for Catalog No. 16

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

ANTON PARALLELS

INCREASE PRODUCTION IMPROVE QUALITY USE ANTON PARALLELS

ANTON PARALLELS FILL A LONG-FELT NEED—Permanently straight and accurate, yet priced for general machine shop use. All parallels fully guaranteed to be within the limits specified. Maximum size tolerance .001 inch on ground sides. Maximum variation in parallelism and straightness within length, .0001. Rockwell "C" hardness 65 up.

ANTON PARALLELS COME IN THREE STANDARD SIZES—

- ¼" Thick x 6" Long—½" to 1-13/16" High in Steps of 1/16". $85.00 per set—22 pairs.
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- ¾" Thick x 6" Long—1-3/16" to 1-13/16" High in Steps of 1/16" $88.75 per set—11 pairs.

Price per set includes a handy Wooden Container. Large Stock of Single Pairs also Available. All Prices are F.O.B. New York

ANTON MACHINE WORKS

52 Sands St. Tel. TR. 5-8092 Brooklyn 1, N. Y.

DEALERS: Morris Abrams, 196 Centre St., New York 13, N. Y.; Arrow Machine Tool Co., Inc., 251 Richmond St., Providence, R. I.; Barwood Co., 3137 N. 15th St., Philadelphia, Pa.; Hansen & Hasle, 135 Myrtle Ave., Brooklyn 1, N. Y.; Toolskill Co., 55 E. Washington St., Chicago 2, Ill.

HUOT DRILL INDEX

Made in nine sizes
No. 80 Wire Gauge to 1 Inch

ASK YOUR DEALER . . . OR WRITE TO

HUOT
MANUFACTURING CO.
127 E. Ninth St.
St. Paul 1, Minn.

BETHLEHEM

Tool Steel Reference List

Bethlehem tool steels range from the straight-carbon types to the highly-alloyed, special-purpose grades so often required in modern practice.

Broadly speaking, the standard Bethlehem tool steels come under seven main headings. The following list is a general guide, and it includes the steels for almost every job in your plant:

	CLASSIFICATION	TYPE ANALYSIS	TRADE NAMES
1.	General-Purpose Tool and Die Steels *(water-quenching)*	C or C-V. 0.70 to 1.40 carbon range	X; Best; XCL; Superior; XX
2.	Safe-Hardening Tool and Die Steels *(oil-quenching)*	Mn-Cr-W-V Ni-Cr-Mo	BTR Bethalloy
3.	Air-Hardening Tool and Die Steels *(air-quenching)*	Mn-Cr-Mo	AH; AH-5
4.	High-Production Tool and Die Steels	High C, High Cr	Lehigh L; Lehigh H; Lehigh S
5.	Shock-Resisting Steels	Si-Mn W Cr-V	No. 71 Alloy; Omega No. 67 Chisel Tough (H and M tempers)
6.	Hot-Work Steels	Cr-Mo W	Cr-Mo-W; Cr-Mo-V No. 57 Hot Work; No. 57 Special Hot Work
7.	High-Speed Steels	W W-Mo	Bethlehem Special High Speed; Comokut; Red Tiger (Improved) 66 High Speed; Moco; HM

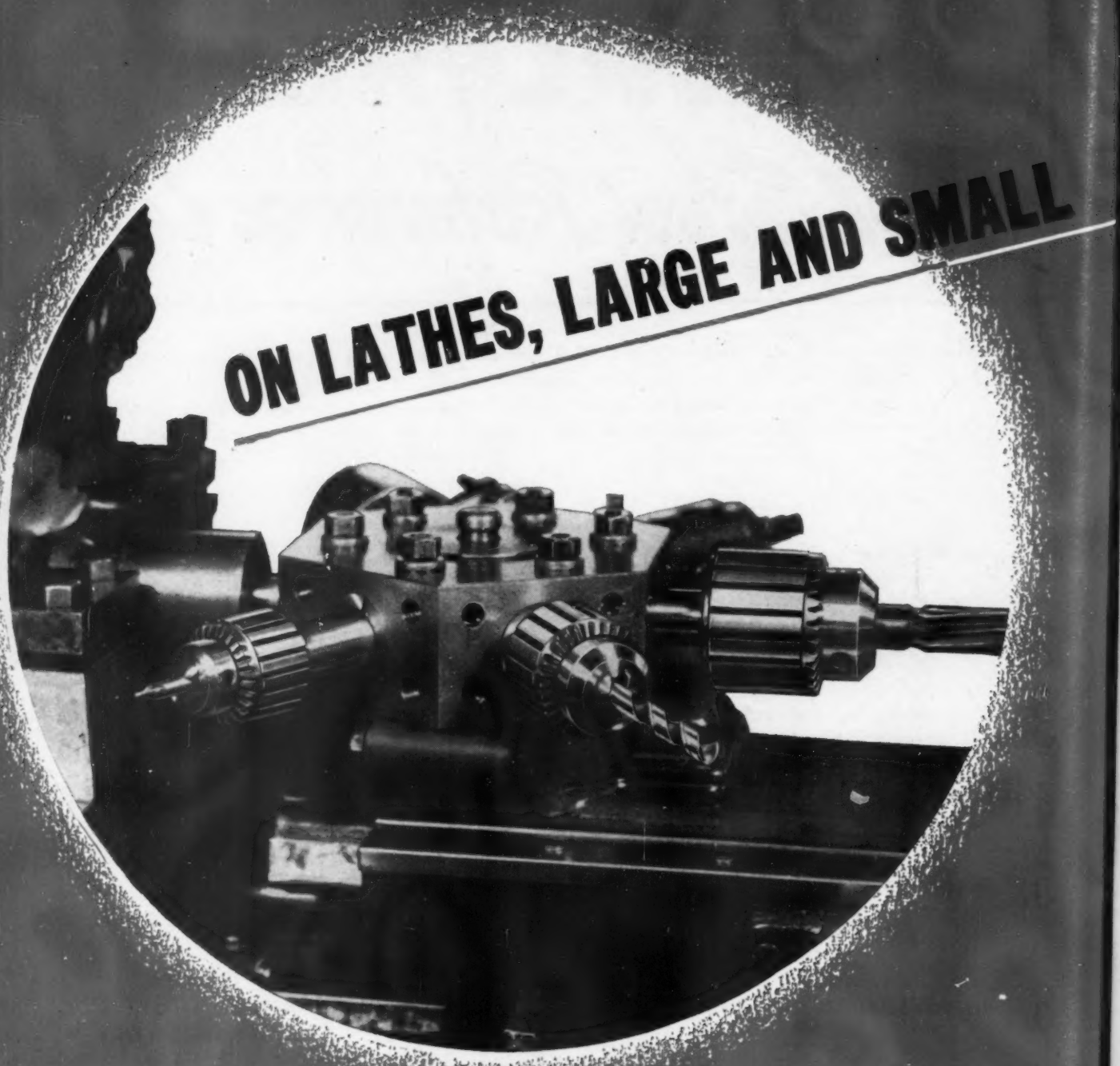
Remember, our specialists are always ready to talk applications with you. Call us when tool-steel problems get tough—or better still, let us work with you from the start.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Bethlehem tool steels for every purpose

BETHLEHEM STEEL



"IF IT'S A JACOBS, IT HOLDS"

Jacobs

. . . the majority choice is *Jacobs Chucks*

The manufacturing routine of many a thriving metalworking plant is built around lathe production. And because Jacobs Chucks link lathe power, speed and accuracy with the work it produces, Jacobs is the choice again and again. Jacobs performance is built on many small, vital details that add up to the world's best drill chuck . . .

Nickel alloy steels for strength and toughness – Areas subject to wear carefully surface hardened – Lands are heat treated for extreme hardness but with adequate core strength retained – Grip sleeves are simultaneously ground internally on three dimensions for balance – Tools can be readily changed and are always accurately centered with a sure grip – Minute tolerances permit ready interchangeability.

In shop or product make Jacobs Chucks your first choice – because "if it's a Jacobs, it holds!"

JACOBS *Ball Bearing*
SUPER CHUCK

Chucks

THE JACOBS MANUFACTURING COMPANY
Hartford, Connecticut

. . . for a mechanical finish far superior to that obtained by hand — use the "PRODUCTION" Type A HIGH SPEED POLISHING MACHINE

Cylindrical work can be fed automatically by means of a power feed through this machine. The Type A represents the highest development of polishing and finishing metals, fibre, rubber, wood, etc. Automatic feeding and holding devices, together with the abrasive belt, assure a mechanical finish far superior to anything yet obtained with hand operations.

An attachment is also available which provides for automatic feeding of tapered cylindrical work. Hand feed may be used on this machine for finishing flat and irregular shapes.

Specifications

Capacity: (with power feed attachment) ¼" to 6" dia.
Speed leather cushion belt—6300' per min.
Floor space—40"x50"
Motor—10 H.P.

Write for illustrated literature giving full details.

PRODUCTION MACHINE CO.
Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines
GREENFIELD, MASS., U. S. A.

New GOVRO-NELSON DRILLING UNIT

MODEL "K"

1. New, free-rolling centrifugal-weight design.
2. Centrifugal mechanism runs in bath of oil. Seals at motor and spindle retain oil—prevent entry of coolant.
3. Three-point, ball-bearing suspension, for smooth operation.
4. Built-in rate of feed control, to provide slow feed for reaming or rapid movement for other operations.
5. Dwell at end of stroke.
6. Can be operated continuously at 40 operations per minute.
7. Simplified method of reset.
8. Completely automatic with electrical controls.
9. Integral foot for accurate alignment.
10. Machined diameter at nose for special adaptations.

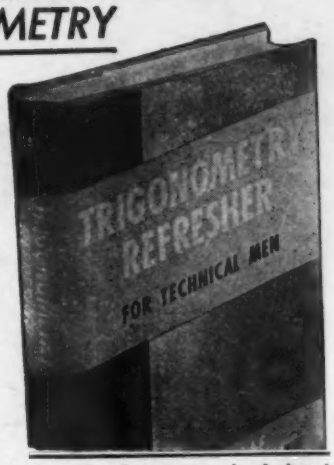
WRITE FOR Literature

GOVRO-NELSON CO.
1933 Antoinette
DETROIT 8, MICH.

Automatic **DRILLING UNIT**

Make your problems simpler and easier to solve

through speedy mastery of TRIGONOMETRY



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Here's a direct way of helping yourself find the answers to today's technical problems quickly and efficiently, without the bother and wasted time that accompany unsure methods. This brisk presentation of trigonometry is designed especially for the busy technical man. It teaches you methods you'll put to use as fast as you learn them. It speeds up the teaching process by the successful "question-and-answer" method which presents the subject clearly and concisely, with emphasis on practical problems in the various technical fields of direct working value to you. The book provides a rapid refresher course for the man who wants to brush up on his trigonometry, as well as a complete and speedy study course for the man who will use it for the first time.

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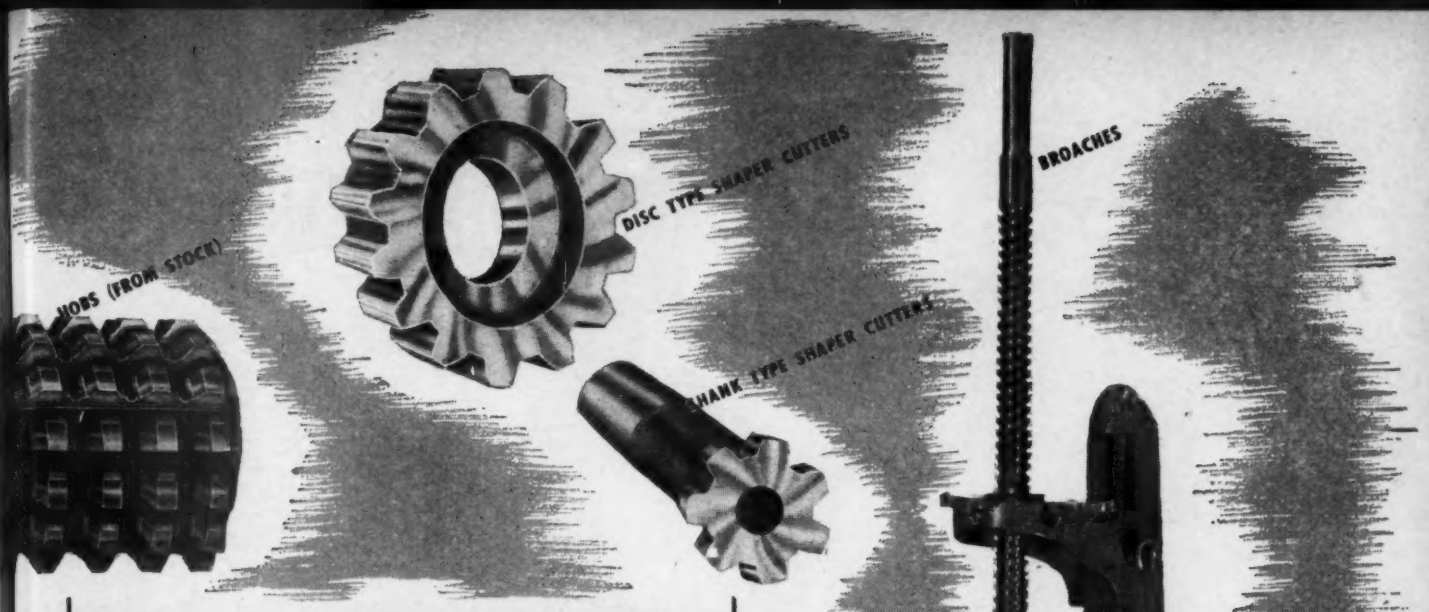

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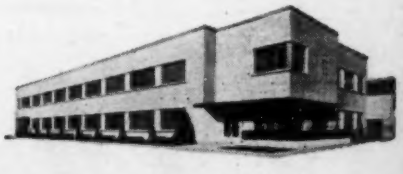

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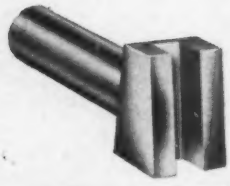

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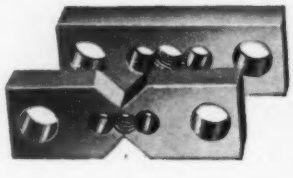

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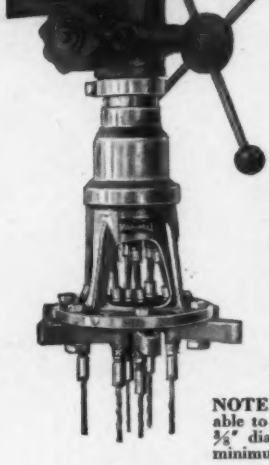

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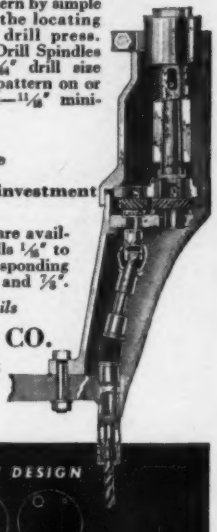

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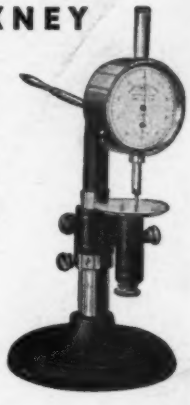

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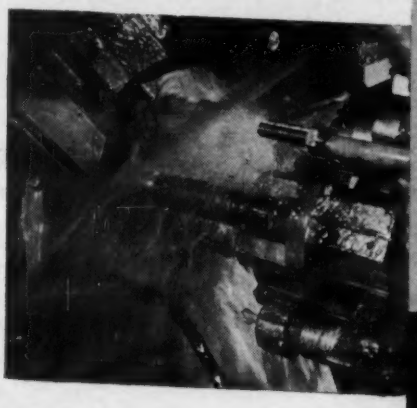

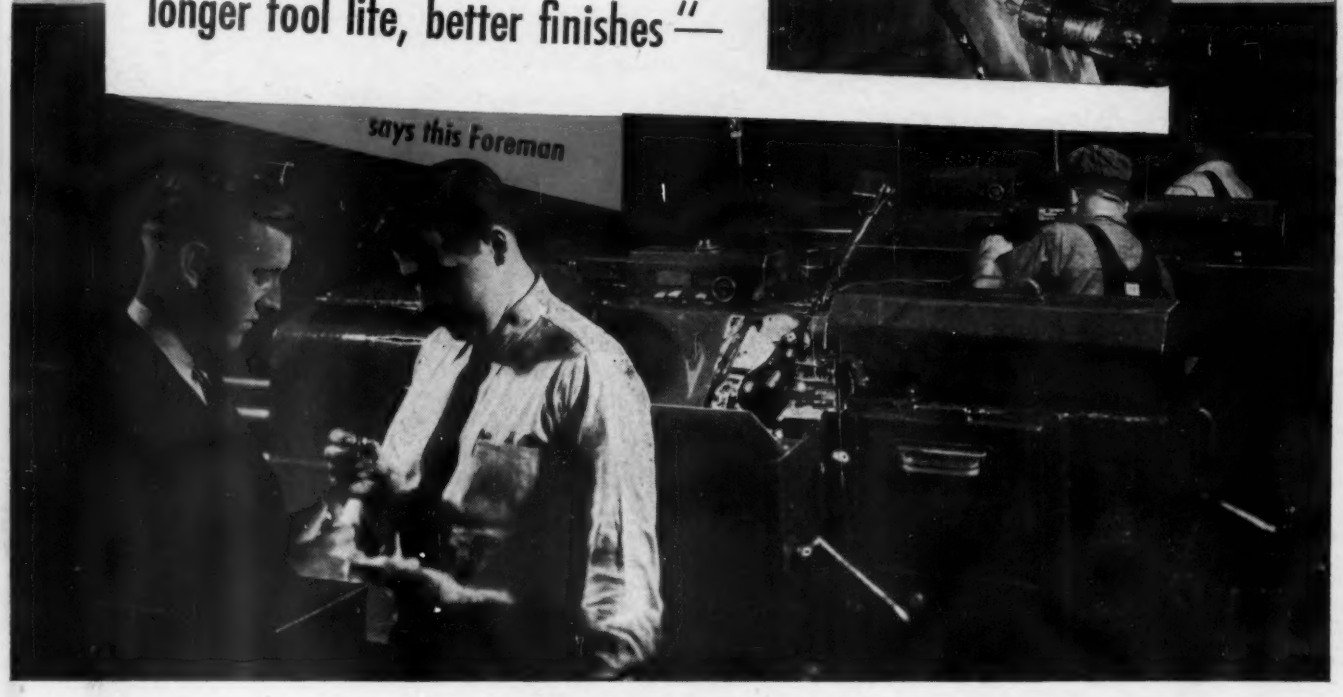

The Department Foreman (right) consults with a Gulf Lubrication Engineer on the performance of Gulf Cut-Aid in machining a brass part. *(Photos courtesy of the Corbin Screw Division of American Hardware Corporation.)*

"PRODUCTION of intricate brass parts on our six-spindle automatics jumped 17 per cent after we switched to Gulf Cut-Aid," says this Department Foreman. "In addition, Cut-Aid keeps the tools and work much cooler, helps us get better finishes, longer tool life, and maintain closer tolerances."

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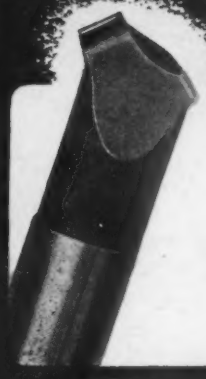

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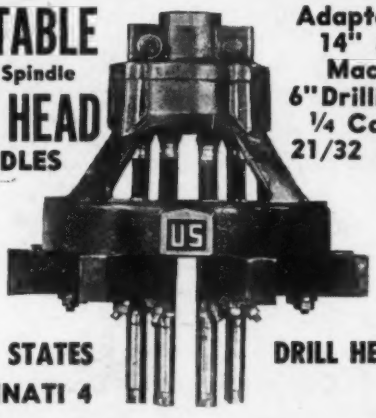

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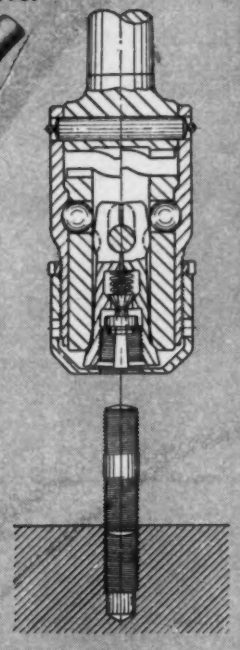
Middle . . . driving position, jaws locked on stud.

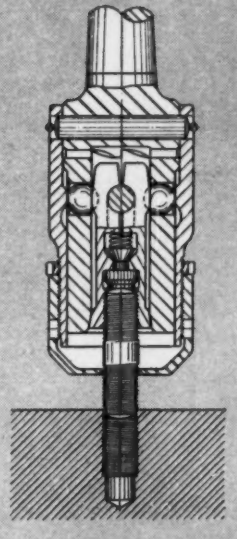
At the bottom . . . stud driven to full depth. The stop collar contacts the work and releases the clutch. Lifting the tool opens the jaws.

The tool revolves in one direction, no reversal, for the complete job.

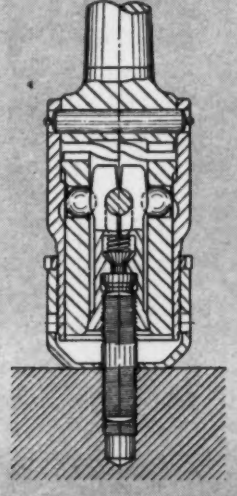
Tool brought to position over stud, about to begin drive.



Start of the drive, with tool engaged on the stud.



Drive completed, with clutch released.



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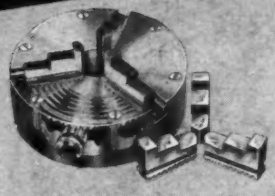

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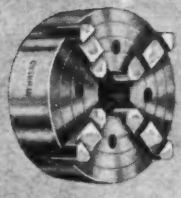
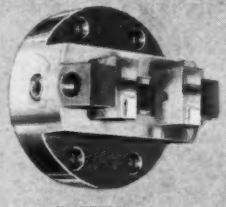
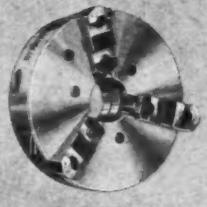


4 JAW INDEPENDENT

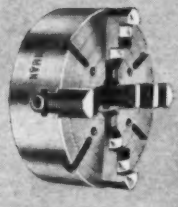
Medium Duty



2 JAW SELF-CENTERING

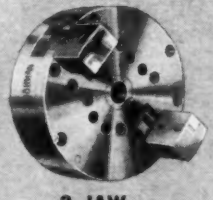


3 JAW SELF-CENTERING



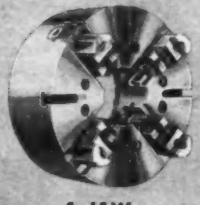
4 JAW INDEPENDENT

Heavy Duty



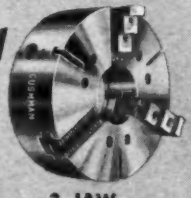
2 JAW SELF-CENTERING

3 JAW SELF-CENTERING



4 JAW INDEPENDENT

Extra Heavy Duty



3 JAW SELF-CENTERING

4 JAW INDEPENDENT

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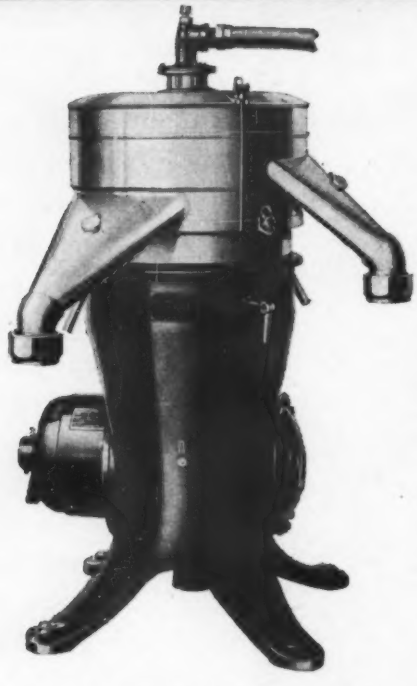

A De Laval Oil Purification System designed for your specific needs will pay off in dollars and cents savings in your plant. Get details in Bulletin FC-5.

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GETS GREATER ACCURACY! Plenty of De Laval-purified cutting oil insures faster, smoother cutting, results in consistent accuracy and less machine "down time" caused by chips and abrasives.

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REDUCES DERMATITIS! A complete De Laval system includes positive sterilization and purification that greatly reduces the causes of dermatitis!

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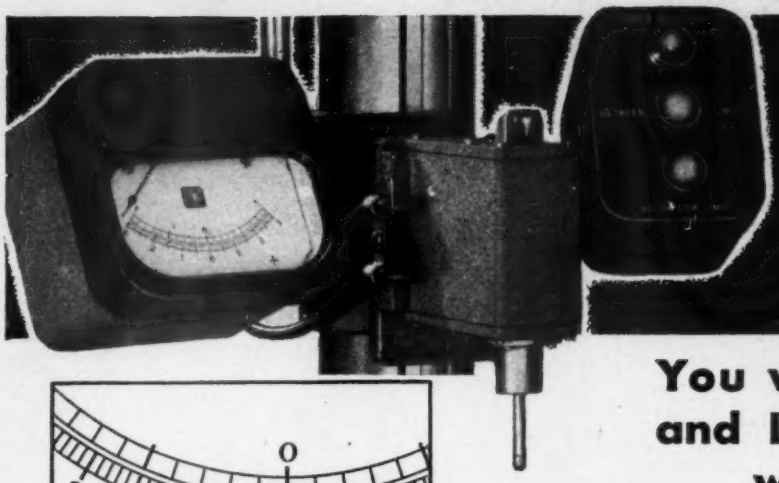
PURIFIERS AND CLARIFIERS FOR FACTORY OILS



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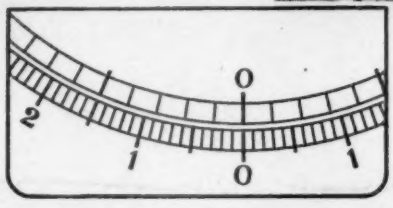
You will SAVE MONEY and IMPROVE QUALITY with This Gage -

It's versatile, exceptionally accurate, sensitive, and very fast



Above section shows actual size scales. You can select any one of 4 magnifications. Minimum graduation either scale .0001" and .00001".

FOUR MAGNIFICATIONS on the Same Dial

INSTANTANEOUS LIMIT LIGHTS

One-pass inspection; no maneuvering, no backstop required.

CONTACT PRESSURE Adjustable from 1½ ozs. to 16 ozs.

Greatest sensitivity of any Gage. Overtravel does not harm gaging mechanism.

ADAPTABLE TO VARIOUS MACHINE and FIXTURE SET-UPS

Contact unit and gaging heads can be adapted to suit requirements.

USE this truly Electronic Comparator in both your shop and laboratory. Small shops find this versatility a big asset. You get two gages for the price of one.

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It has a choice of four differently graduated scales. You are not limited to a single scale. You can read any value from .000010" to .003". Minimum contact pressure is only 1½ ozs.

You can take it out into your shop, and with a flick of a switch it is ready to inspect production having any tolerance from the finest you will ever require, to the widest.

Any operator can use it. The tolerance lights obviate the necessity of reading the dial. And he can't hurt it by forcing the contact spindle.

It is adaptable to various set-ups on any machine or gaging fixture.

We will tell you more about it if you will write —

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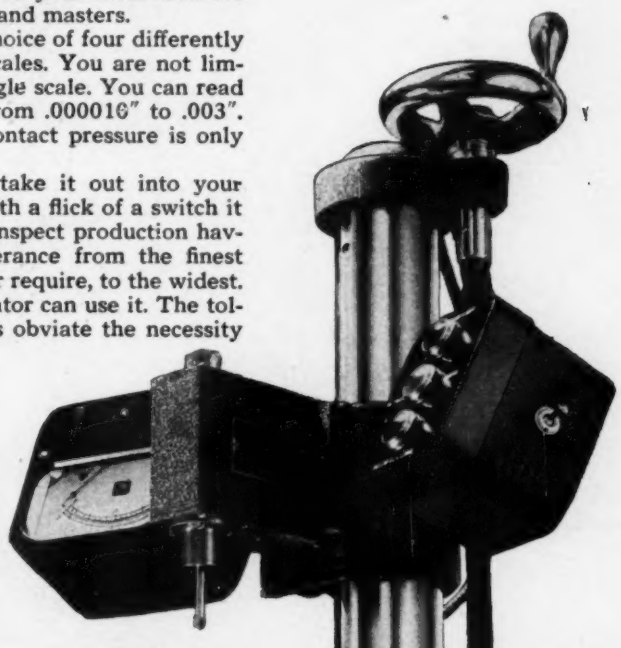
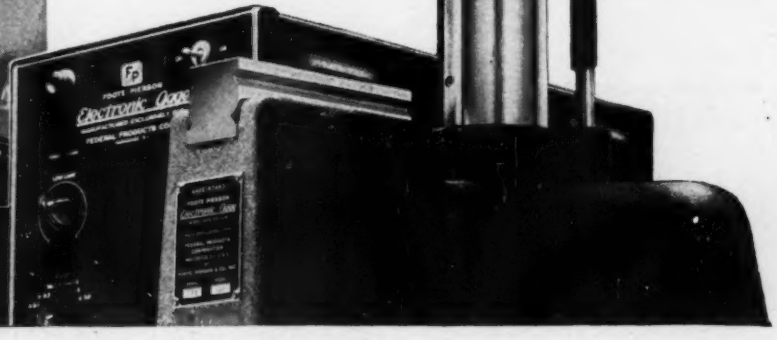
Electronic Gage
MANUFACTURED EXCLUSIVELY FOR





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Provide Protection against Chemical and Dust Hazards

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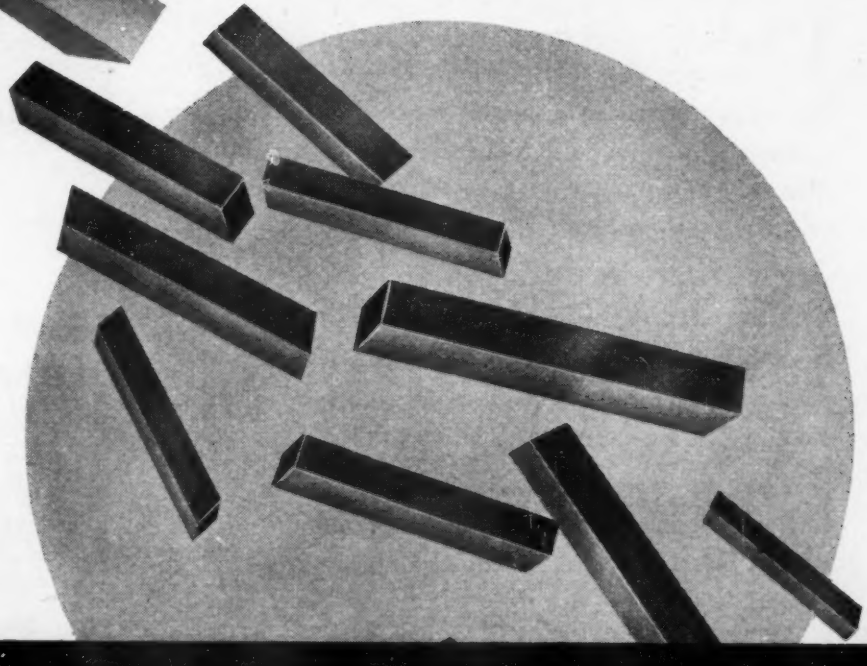

GORHAM TOOL COMPANY

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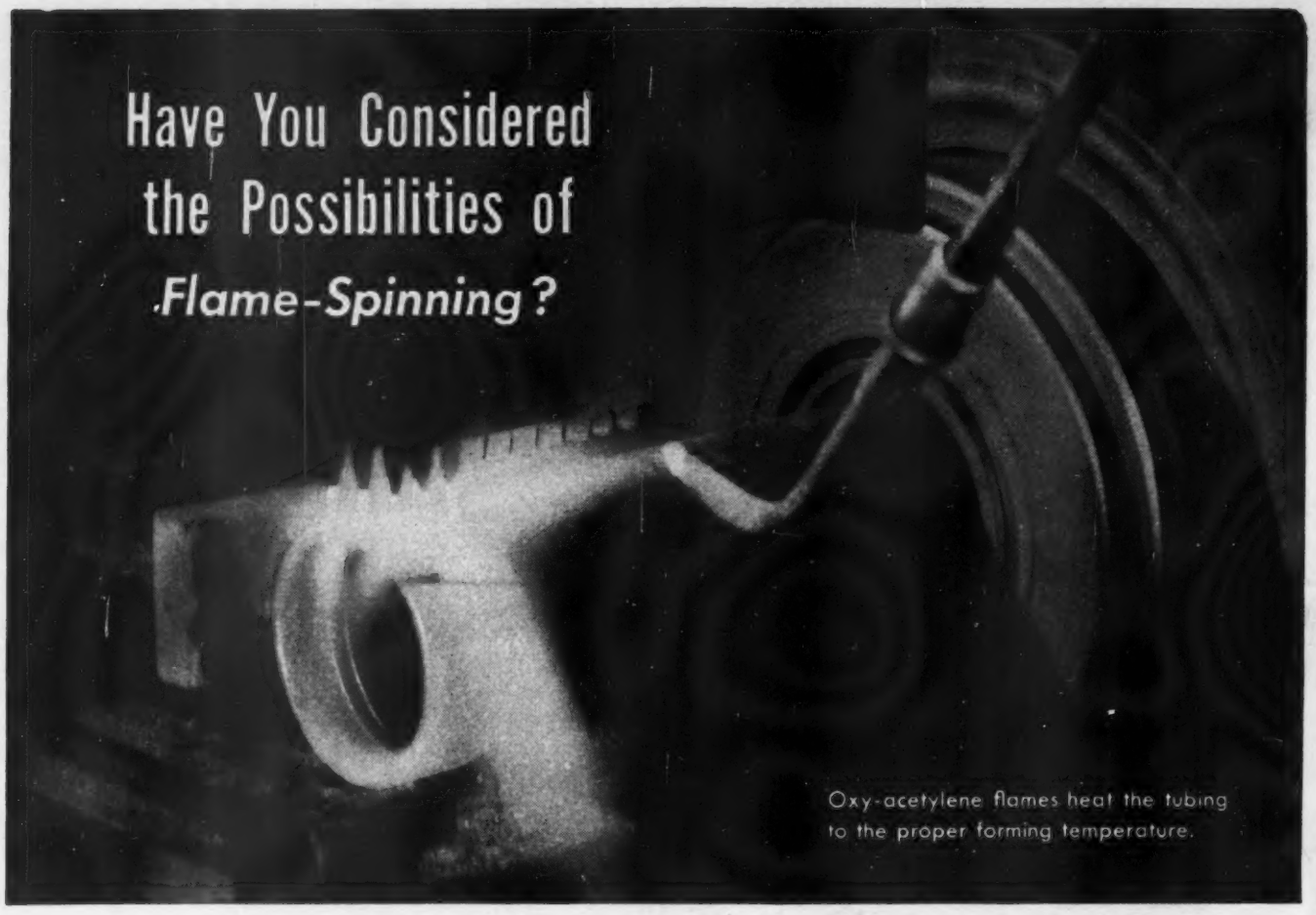
Have You Considered the Possibilities of *Flame-Spinning?*



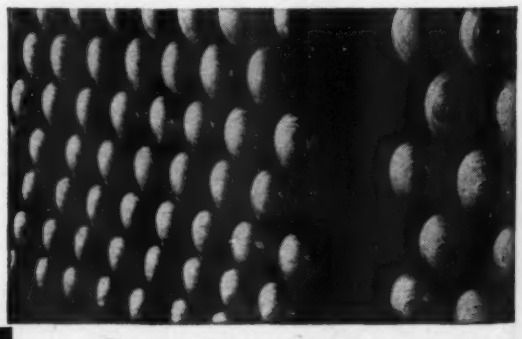
Oxy-acetylene flames heat the tubing to the proper forming temperature.

IT is a fast, inexpensive way to form tubular parts. Flame-spinning will partially close the ends of tubing . . . or make complete closures . . . or reduce diameters at any point. There is no limit to the diameter of tubing that may be flame-spun, provided the ratio of tube diameter to wall thickness does not exceed 50 to 1.

In the pictures, tubing 3 inches in diameter, made from 12-gage sheet, is being end-formed for use in chemical converters. It takes only 45 seconds to close each tube completely.

Ask a Linde representative to show you how you can use the flame-spinning process . . . or write for a copy of the folder, "Flame-Spinning Process," Form 5915.

The flames are withdrawn to allow the forming tool to shape the tube end.



The completely closed tubes are ready for installation in chemical converters.

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When Production Planning Sheet

Full description of the Federal Rocker Arm type of welders is in this Bulletin 4610, available on request.

Further scope in spot and projection welding is described in this Bulletin 4620. Ask for your copy.

Federal Welders Raise Standards of Metal Fabrication...in Small Shop or Large Plant...

The business of making things from metal has come a long way since the days when everything from rainspouts to refrigerator liners was roll-seamed and soldered, not too many at a time, by craftsmen known (with all due respect) as "Tin Knockers". Today Federal Spot Welders play a big role in making Metal Fabricators out of such craftsmen.

In the smallest shops...the largest plant...Federal Spot Welders are speeding and improving fabrication of tremendous tonnages of metal. Variety of production is from small "tack on" jobs, accomplished with amazing speed, to assembly of full-size cabinets, lockers, boxes or what have you. Cuts in costs and "ups" in production are the rewards in each application. Try it on YOUR fabrication.

FOR SPECIAL DELIVERY
Current production permits early shipments on these models
PA 1 Press Type Welders
Rocker Arm Spot Welders
Subject to prior order

Federal Rocker-Arm Spot Welder permanently fastening clips and fittings to component for final assembly. Jigs like this are widely used to speed handling of small welded parts.

THE Federal MACHINE

BULLETIN SP 346—Describing Federal Spot, Flash, Projection, Seam and "Gun" Welders is yours for the asking.

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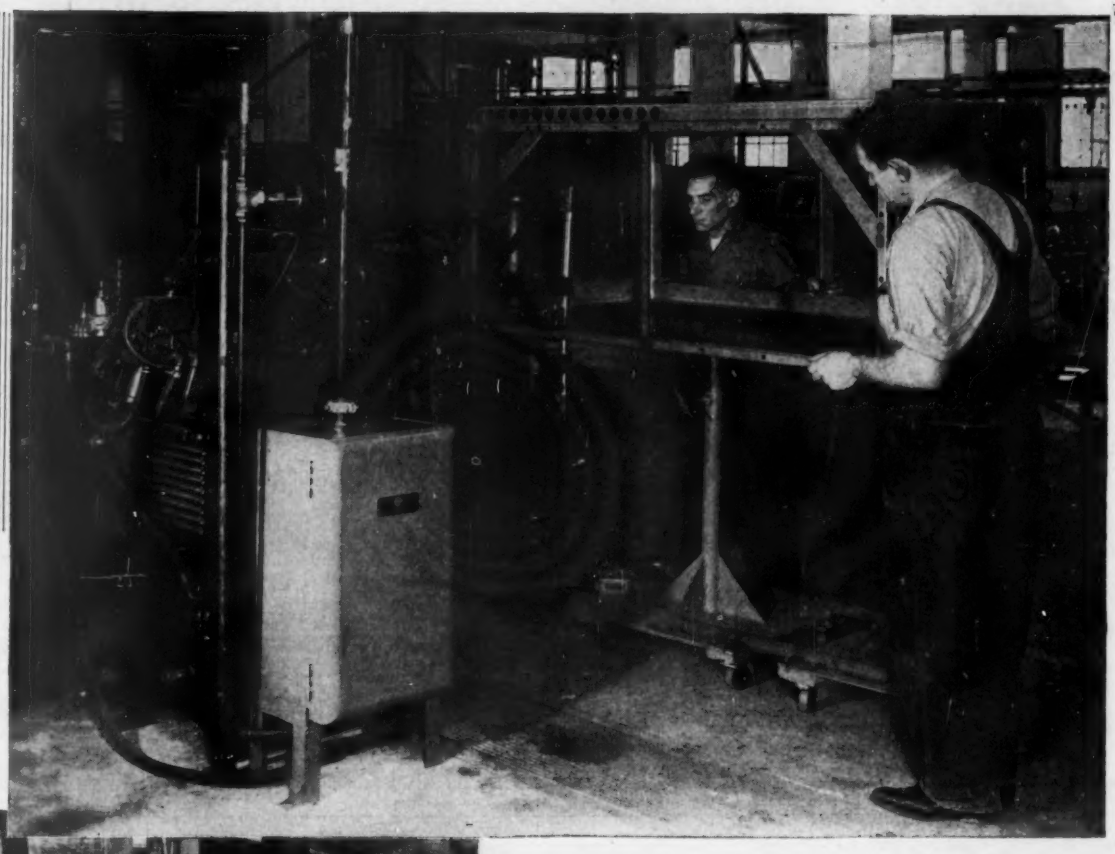

eeze boxes or fur-ces, stoves or store fix-res, all types, all sizes, e "duck soup" for deral Rocker Arm Spot elders. This one is rt of a very modern lding production line.

le special lower electrode fixture aids location of spots in this small ation. Machine is one of a line of Federals in a large scale "job" shop reputation for making "anything" from sheet metal.

Another production line application of Federal Rocker Arm Spot Welders, where speed and consistent performance are important.

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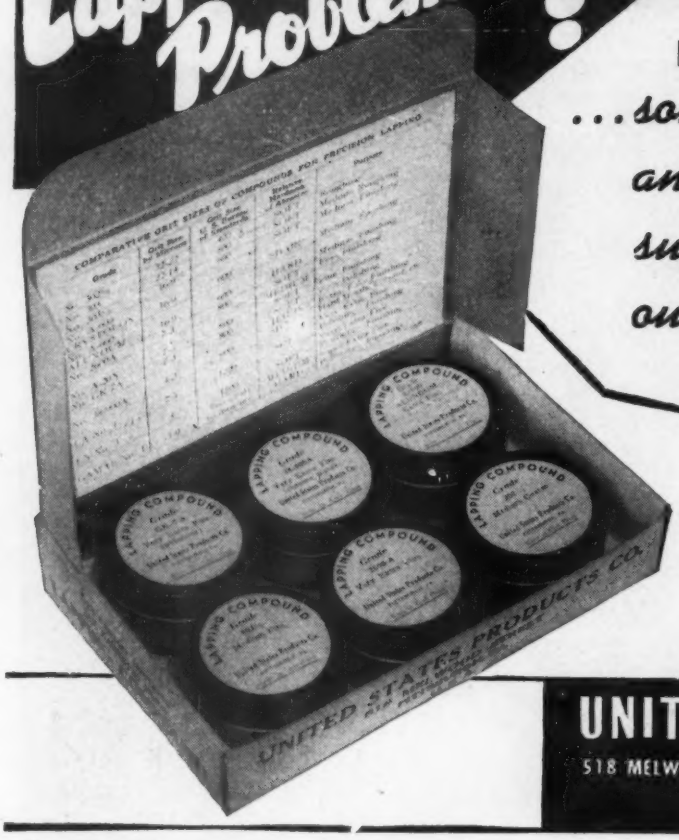

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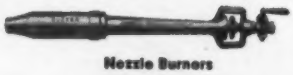
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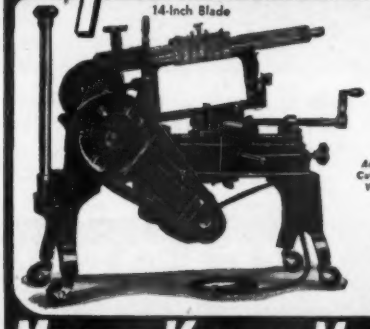

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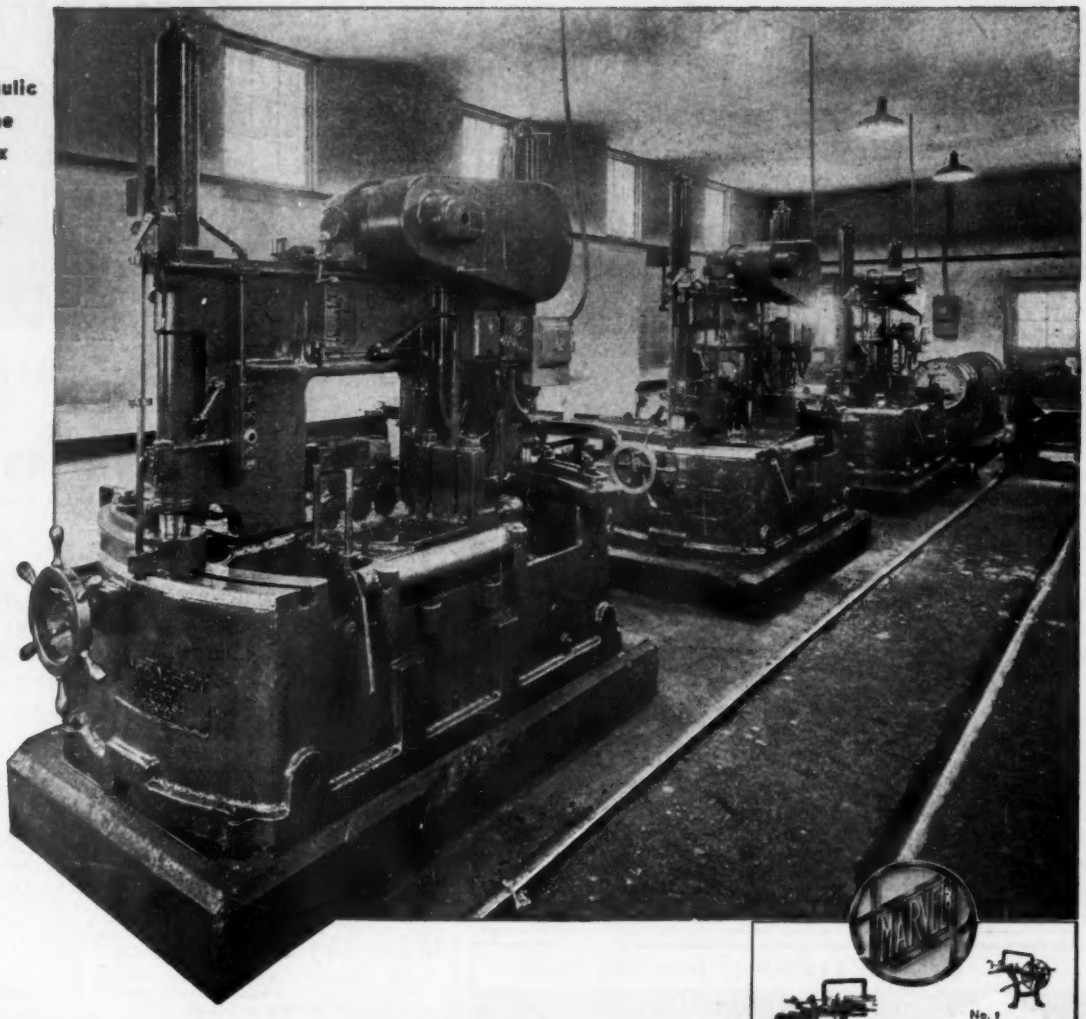
WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

3 MARVEL #18 Hydraulic Hack Saws at the Babcock & Wilcox Tube Co.— Beaver Falls, Pa.



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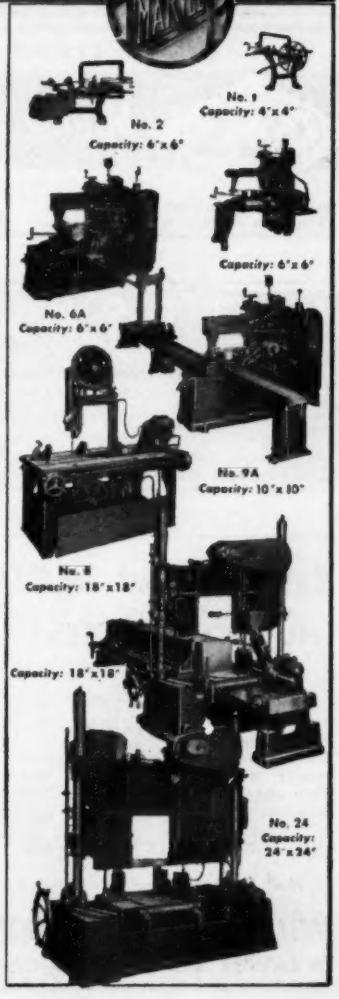

MARVEL SAWS

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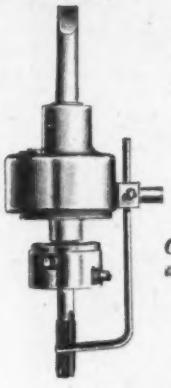
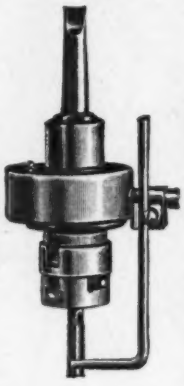
" 00	3/32"
" 0	1/8"
" 1	5/32"
" 2	3/8"
" 3	5/8"
" 4	3/4"
" 5	3/4"





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OK *Milling and Boring Tools*

See Issue November 7th, 1946 American Machinist

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Patented Cutting Off Blades

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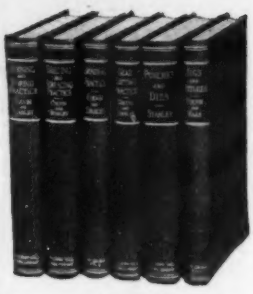

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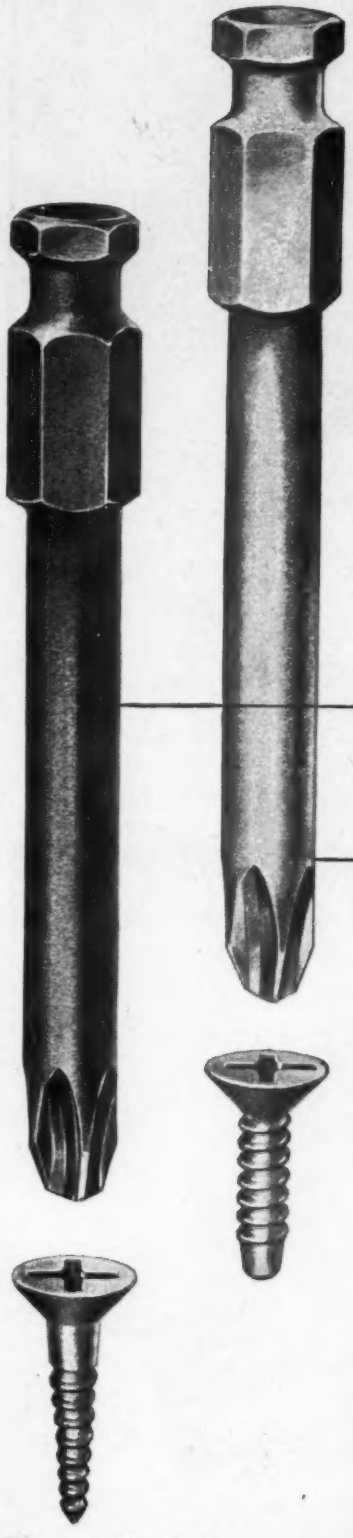

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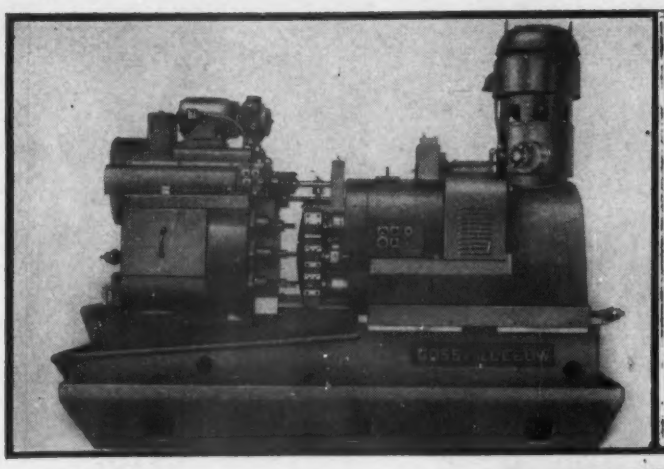

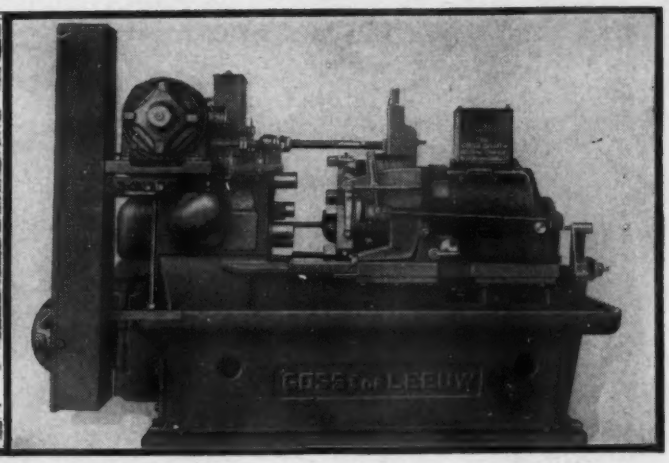

WORK ROTATING TYPE

5 Spindles
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8 Spindles

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SMART APPEARANCE is an asset in any business. That's why it's wise to specify Reeves Army Twill for uniforms and work clothes that always look their best. Their high tensile strength assures rugged wearability. Vat dyed colors are fast to sun, water and perspiration. Sanforized Shrunk*, they retain their smart tailoring—even after repeated washings. Remember—over 90 million yards of this same cotton fabric helped equip America's fighting forces—exceeding Government specifications under the toughest combat conditions.

**Residual shrinkage less than 1%*

THE REEVES FABRIC GROUP INCLUDES:

Reeves Army Twill • Glengarrie Poplin
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MADE OF FINE COTTONS

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REPRESENTATIVES IN *Atlanta • Boston • Chicago • Dallas • Los Angeles • Philadelphia • St. Louis • Montreal • Toronto*

TWELVE HUNDRED HANDS TO FIND THE FACTS

FOUR hundred field correspondents ferret out, spade up, shoot in stories from all over the world of industry. Two hundred editors, bristling with Ph.D.'s and practical engineering and scientific knowledge, cull and correct and explain and expound. That's McGraw-Hill.

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You men who keep machines in working trim know that bearings are often hard to get these days. So call in your nearest Authorized SKF Distributor. Under present conditions he may not have just the bearing you need, but he can suggest a substitute that will keep you going until he can get you the right one. He knows bearings from the ground up . . . and the bearings you need to save time, money and manpower. Not only can he help you in selecting bearings but also in their installation, lubrication and maintenance as well. He's a good man to know—and the other end of your telephone is on his desk.

6089

SKF

BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILA. 34, PA.

How to give a Bigger Bonus

...without budging your budget a bit!

SUPPOSE Bill S., one of your employees, is due for a $75 bonus this year. If you give the bonus in U. S. Savings Bonds, Bill will receive—not $75, nor a $75 Bond—but a *$100* Bond.

Yes, the bonus in Bonds looks like a lot more—and it *is* more. (Every $3 put into U. S. Savings Bonds pay $4 at maturity.) With the same size appropriation, you're actually giving a bigger bonus.

Consider, too, that Savings Bonds mean individual security for each Bond-holder—and collective security for all of us, because they help to control inflationary tendencies. You can easily see that you're doing yourself, your employees, and your country a favor by deciding to...

Give the BONUS in BONDS

...and keep up your Payroll Savings Plan!

IMPORTANT: If you have not already received your copy of "How You Can Help Give Free Enterprise a Boost," write on your letterhead to: Room 750, Washington Building, U. S. Savings Bonds Division, Washington 25, D. C. Limited supply. Please write today.

The Treasury Department acknowledges with appreciation the publication of this message by

American Machinist

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

To Sensitize Metal...

for Making Templates

By PROJECTION or CONTACT

USE **DINOLOFT**

"IT'S LIGHT TIGHT"
PHOTO TRANSFER

Quickly and Easily applied to metal—by customer or by Di-Noc—to render the metal photographically light sensitive. The Dinoloft Transfer is a photographic emulsion in combination with a white or clear lacquer type base coat to give strength. It is built up and laminated on an *opaque black paper base* which after application to the base material—steel, masonite, plywood, etc.—acts as a light seal preventing danger of fog during handling and storage.

When ready for exposure the opaque black paper is simply dry-stripped from the base and normal photographic procedure and processing followed. Properties insure positive adhesion to the base material and permanent, sharp, intense, black images.

PHOTOGRAPHIC DI-NOC PRODUCTS

THE DI-NOC COMPANY
PHOTOGRAPHIC DIVISION • • • CLEVELAND 12, OHIO

Other DI-NOC registered Trade Mark photographic products are: DINOBASE, DINOGRAPHIC, DINOREFLEX, DINOBLUELINE AND DINOCLOTH

EDWARD

Blake

COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

SHARPEN Small Formed CUTTERS as Easily as saying "A.B.C."

With the WALTHAM CUTTER SHARPENER you simply:

A. Mount cutter and fine-adjust first tooth using rotary feed screw.

B. Rock spindle forward—this sharpens the first tooth.

C. Rock spindle back—meanwhile twisting spindle to the next index stop. (The spindle is ready for rocking forward to grind the second tooth. That's all there is to it: ROCKING FORWARD AND BACK, and INDEXING for all the remaining teeth.)

This *SIMPLICITY* of operation enables unskilled labor to learn quickly to sharpen all types of gear and thread milling cutters, straight-fluted hobs, or multiple cutters—from the smallest size up to 3½ inches in diameter and ⅜" thick. Or your regular operators can use it in conjunction with their other machines.

The result of many years of experience in manufacturing small cutter grinders, the Waltham makes cutter sharpening a FAST, ECONOMICAL and ACCURATE operation. It's small, rugged and self-contained—can be used on any convenient bench where a 110-volt outlet is available.

It's also an especially versatile cutter sharpener. It can be used for rake or radial sharpening . . . with indexing plates or with a pawl device for locating on the top or back of the teeth.

The coupon below will bring you the complete details, without obligation.

Please send me Bulletin No. 345 which gives full details on the Waltham Cutter Sharpener. A.M.

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COMPANY _____

STREET _____

CITY _____ STATE _____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS

Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on page 208, Dec 5, '46 American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
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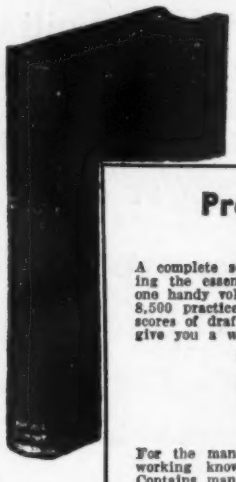

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Late Professor of Mathematics, Armour Institute of Technology

AND S. F. BIBB
Associate Professor of Mathematics, Illinois Institute of Technology, Armour College of Engineering

Practical Mathematics for Home Study

A complete self-instruction course in usable mathematics, covering the essentials of arithmetic, geometry, and trigonometry in one handy volume. Worked out examples at every step, and over 8,500 practice problems show you how to apply mathematics to scores of drafting room, machine shop and construction problems, give you a working knowledge of fundamentals and methods.

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TOOLS • DIES • JIGS • FIXTURES • MOLDS • STAMPINGS • FORGINGS • SPECIAL MACHINERY • DEVICES • PARTS • SCREW MACHINE PRODUCTS • CASTINGS

WANTED PRODUCT OF CONTRACT WORK

Machinery manufacturing concern with extensive experience desires a product to manufacture on a contract basis or straight contract work.
Manufacturer has modern well equipped machine shop, capable of making small, medium or large machinery, tools, jigs, fixtures, gages, stamping dies, stampings, electronic assemblies, gear drives and small parts of all types. Excellent engineering facilities and good contacts for all types of foundry work are available.

Send for our bulletin #10A

C. W. JARVI MFG. COMPANY, INC.
NORTH ATTLEBORO MASSACHUSETTS

SPECIALTIES—PRECISION WORK

Available capacity for automatic screw machine products up to 1⅝" diameter.

Equipped for secondary operations: Thread rolling and chasing, centerless grinding, slotting, drilling, heat treating, and plating.

Forward blueprints for quotations. Prompt-efficient service.

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La Salle Engineering Co.
TOOLS, PRODUCTS, SPECIAL MACHINES; DESIGN & BUILD
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PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them
GENERAL PATTERN WORKS
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SEND B.P. FOR MFG. COMPLETE ASSEMBLIES
Tool—Jigs—Dies
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Stampings—Gears
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Put Your Idle Capacity to Work

Hundreds of metal-working companies are finding profitable business today outside their regular lines. Tell metal-working America—the 100,000 readers of American Machinist—about your facilities. Write

Classified Advertising Division
AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

CONTRACT WORK WANTED

Turret lathe capacity to 2½" diameter bar size; also, light engine lathe and milling machine work.

WAYNE MANUFACTURING CO.
Honesdale Pennsylvania

HOBBING PRESSES

Self contained units for prompt delivery 11" Left to right 18" Front to back for Hobbing mold cavities die sinking Etc.

M&N MACHINE TOOL WKS.
149 Orono St. Clifton, N. J.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

POSITION VACANT

CONTACT MAN Wanted by medium sized Tool & Die Shop in Detroit, Michigan, for Indiana, Ohio and Illinois area, for Jigs, Fixtures Multiple Spindle Drill Heads and Special Machinery. Must have very good sources—Commission basis. P-827 American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotiations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc. 266 Dunn Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

TOOL, DIE and Model Maker, Also Tool Trouble Shooter, 35 years practical experience, desires connection with progressive concern in Supervisory Capacity. PW-820, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

PRODUCTION ADMINISTRATIVE Executive: 25 years of unusual and successful "Management" background. Thoroughly experienced in all phases of "Plant" and "Administrative" procedures, controls and methods. Positions held in capacity of Works Manager and Chief Industrial Management Executive. New York vicinity preferred. PW-810, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALES EXECUTIVE, Desires position as sales manager or sales engineer. Excellent background contacting plants, developing and organizing manufacturers agents, jobbers, dealers on national basis. Gages, measuring instruments and small tools preferred. PW-828, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PROCESS ENGINEER. Young graduate Mechanical Engineer 23, alert and agressive, desires a position with a progressive manufacturing concern as a Methods-Process Engineer that will afford an opportunity to take training in machine shop practice. Now working as a Process Engineer. Veteran. Prefer North Jersey or New York area. PW-829, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 288)

WANTED
Superintendent
Punch Press Dept.

Old Established Company; Town 15,000. Fifty Presses up to 100 Tons. Not a Jobbing Shop. Running two shifts and must run three. Good working conditions. Paying highest rate in area. Salary $500.00 per month plus, to start. Loafers—drifters need not apply. State age, experience since beginning work, salary received, and full particulars your qualifications. WILL GUARANTEE HOUSE.

P-826, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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(Not available for equipment advertising)

10 cents a word minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A. M. December 16th will appear in the issue of January 2nd subject to limitation of space available

SELLING OPPORTUNITY WANTED

(Continued from preceding page)

ESTABLISHED IMPORT & export firm located in Shanghai, China desires additional connection with leading manufacturers. References furnished. Address: Ray Snyder c/o Dean Company, 26 O'Farrell Street, San Francisco 8, California.

PATENT ATTORNEY

PATENT and Trade-Mark Practice before U. S. Patent Office. Validity and Infringement Investigations and Opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine & Rommel, Registered Patent Attorneys, Suite 453, 815-15th Street, N. W., Washington 5, D. C.

WANTED — SALES MANAGER

Experienced: Sales of Machine Tools, Metal Fabricating Equipment. Sales Promotion, organize territories, quotas, systems, reports, customer correspondence, engineering Sales letters. Assume direct charge of Salesmen.

An excellent opportunity with a Chicago concern for an aggressively active Sales organizer and Manager.

SW-825, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

British Firm of Manufacturers Agents

Seek agencies for steel strip, sheets, tubes, sections & stock, brass strip, conveying chain, electric & fractional H. P. motors, industrial porcelain insulators, bearings or first class finished products.

GERALD O'DONNELL
Moreton-in-Marsh Glos., England

Notice to Advertisers

Because of the Christmas & New Year Holidays the "Searchlight" pages of the

January 2nd Issue of

AMERICAN MACHINIST

Close for press earlier than the usual weekly closing time.

The cooperation of advertisers is solicited in forwarding new copy, or changes of copy, to reach us accordingly.

FINAL CLOSING TIME
Display and Undisplayed Ads
Monday, December 16

THREAD GAGES—PLUG AND RING

Slightly used, NF-2 & 3, ¼ to 1", 6, 8, 10 M.S. Also 1 to 4" N.S.

LESS 75 Percent Discount.

ADJUSTABLE SNAP GAGES. ALL SIZES. ½ to 8".

LESS 75 Percent Discount.

DE WITT TOOL COMPANY
173 GRAND STREET NEW YORK 13, N. Y.
Send For Our Bargain Circular

NEED MACHINERY FOR LIGHT METALS MANUFACTURING?

FARNHAM countersinkers, carriage drills, spar millers, forming rolls are known wherever light or heavy metals are fabricated.

Used machines are available at surplus centers. We can rebuild and guarantee them as new.

FARNHAM
MANUFACTURING COMPANY
1646 SENECA ST., BUFFALO 10, N. Y.

PETITT BROS. MACHINERY CO.

If You Want to Buy, Sell, or Trade One Machine or Entire Plant Consult Us Immediately
FRED PETITT — ALBERT PETITT
OFFICE AND WAREHOUSE
1240 WEST 4th ST. CHERRY 0609
CLEVELAND 13, OHIO

WANTED

WANTED

FISHER No. 2
OIL GROOVER
OR
LARGE HORIZONTAL
WICACO OIL GROOVER

•

SHOOK BRONZE CORP.
Greenlawn and Lake Sts., Lima, Ohio

EQUIPMENT FOR SALE

1—307A Barnesdril single spindle, hydraulically reciprocated twin cylinder Honing Machine, Model F206D

1—Lees-Bradner Model 40, Automatic Chucking Thread Milling Machine

1—Warner and Swasey 3A Universal Hollow Hexagon Turret Lathe—M-1950

1—Gisholt 2L Saddle Type Turret Lathe

1—Gisholt 3L Saddle Type Turret Lathe

The Cessna Aircraft Company
WICHITA KANSAS

FOR SALE

MODERN FULLY EQUIPPED METAL PARTS MANUFACTURING PLANT.

20,000 Sq. Ft. 1-story brick building in Los Angeles, California. Open shop with no labor, power or fuel problems. Central location on spur track. Possession 30 days.

N. M. SAUNDERS CO., *Sole Agent*
210 W. 7th St., Los Angeles 14, Calif.

INDUSTRIAL RADIO FREQUENCY GENERATOR

Nearly New-Westinghouse 20 KW-450 Kilocycles. Bought New May 45 used 168 Hrs.—Less than 1 percent life expectancy. $6,900. Includes a few electrodes.

VARD INCORPOATED
2961 E. Colorado, Pasadena 8, California

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

2—#00 Brown & Sharpe Full Automatic, Standard Speed

1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.

1—#515 National Acme 9/16" 4-spindle Automatics, complete

LATHES

Logan Q.C.G. Lathes (new).
Sebastian Engine Lathes (new).
1—LeBlond Heavy Pattern 24" x 12' 3-step cone Engine Lathe
13" x 6' Williard, geared head
14" x 6' Hendey Yoke Head
14" x 6' Rockford Cone drive (two)
14" x 20' Hendey Toolmakers Lathe.
16" x 6' American Motor Driven Lathe.
16" x 8' Lodge & Shipley 12-speed Grd. Hd.
18" x 6' Chard, M.D.
18" x 10' American, Geared Head, Taper.
18" x 222" Hendey, M.D. (two)
20" x 10' Hendey with Taper.
20" x 11' Schumacher-Boye, M.D.
24" x 24" American Lathe, motor dr.
28" x 10' Davis cone driven
48" x 30' Simmons Geared Head, 1941.

TURRET LATHES

4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Turret Lathe, Motor Driven.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal.
#3R Gisholt Universal like new.
#4 Foster GFH Hand Turret Lathe.
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)
Bullard 42" Vertical Turret Lathe

TURRET PUNCHES

Hecker, vertical type, 8-station, air operated, 18" throat.

PLANERS

20" x 20" x 24" N.B.P., Planer Shaper.
26" x 26" x 8' Gray Planer, 2 heads.

RADIAL DRILLS

4' Arm, 11" Column Cincinnati-Bickford.
5' Arm, 13" Column Cincinnati-Bickford.
5' Arm, 14" Column Fosdick, motor drive.
6' Arm, 15" Column Cincinnati-Bickford.
3½', 10" Col., Cincinnati-Bickford AC Motor Drive, Gear Box.
1—Leland-Gifford 6-spdle. Drill Press (late model) ind. spdle. motors.
Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

FOUNDRY MOULDING MACHINES

2—#0 Johnston & Jennings, Jolt Squeezer Draw Pattern, serials #58382197, #2196.
2—#42 Osborn Rockover and Draw Machines, 14" x 20½" table
3—#342 Osborn Jolt Rollover Pattern Draw Moulding Machines
2—Spo Hand Rollover Power Draw Moulding Machines complete with with run-out cars.

SHEARS & METAL WORKING

Lennox Splitting Shear ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Peckstow 30" x 18 ga. Squaring Shear.
Gould & Eberhardt Slitting Shear, 10 ga.
Niagara 48" Roller Leveller, 6 Rolls.

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
#1-#1½ Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Thread Miller, Hall Planetary #1—24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#3B Hendey Universal Miller, motor drive.
#4 Cinn. Vertical High Power Miller. (2).

MISCELLANEOUS

15 KVA Ace Spot Welder, 18" throat, 1/60/440 volt.

GRINDERS

Queen City Dble. End Grinders, motor driven (new).
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
1—Gardner Dble. Opposed Grinder #14
1—Seybold 96" Knife Grinder
Oliver of Adrian Drill Grinders
Cincinnati Centerless Grinders #2 M.D.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole; 4" deep.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.
2—Cincinnati, #1½ Tool & Cutter Grinders.

BORING MILLS

3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M. T.

POWER PRESS HEADQUARTERS

Famco Arbor & Foot Presses (new).
#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed. 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
Hilles & Jones #4 Single End Punch and Shear. Equipped as Plate Shear with 18" Blades. ARR, motor drive, 54" throat.

SHAPERS & GEAR CUTTERS

1—Whipp 16" B. G. Crank Shaper.
1—Fellows #6—36" Gear Shaper.
Barber-Colman Gear Hobbers #2, #3.
1—Brown & Sharpe #3—26" Automatic Gear Cutter.
#1 Adams Gear Hobbers, Belt driven (2).
24" American Direct Motor Drive.
Slotter 12" stroke New Haven, motor drive.

2—#16 Blanchard Surface Grinder, 30" dia., magnetic chuck, 25 h.p. motor on spindle.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter.

Approved Dealer War Assets N. Y. 47

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Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY
Machinery Merchants

18 WARD ST.
ROCHESTER 5
N. Y.

QUALITY *Machine Tools*

NOW IN STOCK

No. 2A Pratt & Whitney Jig Boring Machine, with power driven rotary table, complete accessories. Perfect condition. New in 1943.

12′ x 3/8″ Bertsch Combination Punch and Shear, with 18″ gap, double geared, motor driven.

AUTOMATICS
5½″ Cleveland Model A, single spindle.
16″ x 33″ Fay Automatic Lathe.
⅞″ Cleveland Model M, four spindle.

BORING MILL
No. 31 Lucas, motor driven.

DRILLS
★ **4 Ft. American Hole Wizard Radial Drill, motor on arm, new in 1940.**
No. D2 Colburn, single spindle.
No. 314 Baker, single spindle.
42″ Cincinnati Bickford.
Allen Sensitive Drill, four spindle.
★ **No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20″ x 40″.**
Pratt & Whitney Gun Barrel Drill.
LeBlond Gun Barrel Drill.

GEAR CUTTERS
Model A and D Barber-Colman Gear Hobbers.
No. 3 and No. 12 Barber-Coleman Gear Hobbers.
No. 61 Fellows Gear Shaper, m.d.
6″ Gleason Str. Bevel Gear Generator.

GRINDERS
36″ x 168″ Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 16-26″ Blanchard Surface Grinder.
No. 72A3 Heald Sizematic Int. Grinder.
No. 72A3 Heald Gagematic Int. Grinder.
No. 13 Brown & Sharpe Universal & Tool.
10″ x 24″ Norton Cylindrical Grinder.
10″ x 72″ Norton Cylindrical Grinder.
10″ x 24″ Thompson Hyd. Surface Grind.
No. 2 & No. 3 Cinci. Centerless Grinder.
No. 35 Excello Thd. Grndr., new in 1943.
No. 5VRO Hammond Buffer.

LATHES, ENGINE
14″ x 6′ Sebastian, motor in base.
16″x6′ Hendey, g.h.
20″ x 12′ Lodge & Shipley, g.h.
48″ x 12′ Lodge & Shipley, C.D.
No. 12 Gisholt Hyd. Lathe.
LR Lo-Swing Lathe, m.d., new in 1940.
15″ x 30″ Lipe Carbo-matic, new in 1943.

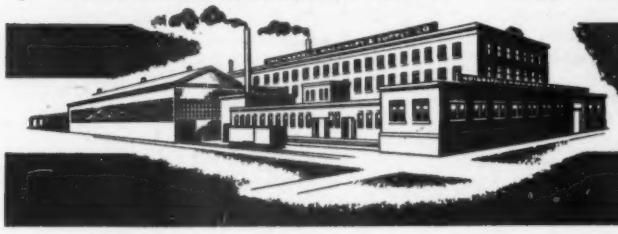
LATHES, TURRET
No. 3A Warner & Swasey, g.h.
No. 2A Warner & Swasey, Timken Bearing, new 1942.
No. 1A Warner & Swasey, g.h., new 1943.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 1 Bardons & Oliver, c.d.
No. 1 Brown & Sharpe, m.d.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

MILLS
No. 31 Lucas Horizontal Bor'g Mill, m.d.
No. 36 VanNorman, Ram Type, m.d.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3 Cincinnati Universal, s.p.d.
No. 4 Cin. Plain, Rect. Overarm.
No. 2H Milwaukee Plain double overarm, motor in base.
No. 2-MH Cincinnati Plain, m.d.
★ **No. 4H Milwaukee, Double Overarm, motor in base, new 1940.**
No. 2H Milwaukee Vert., motor in base.
No. 2209 Milwaukee, Table 22″ x 158″.
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.

MISCELLANEOUS
No. 17 Greenerd Arbor Press.
No. 100 Micromatic Hydrohoner.
8″ x 7″ Troy Vertical Steam Engine.

PLANERS AND SHAPERS
16″ Gould & Eberhardt Crank Shaper, m.d.
24″ Gould & Eberhardt Crank Shaper, s.p.d.
★ **6″ Pratt & Whitney Vertical Shaper.**
36″ x 36″ x 12′ Liberty Planer, 2 heads, box table.
42″ x 42″ x 20′ Cin. Planer, D.C. Rev. m.d.

(Approved Dealer for War Assets Administration Surplus Machines)



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MDNA MEMBER

RADIAL DRILLS
6′ WESTERN, B.G., No. 5 M.T.
6′ AMER., 15″ Col., No. 5 M.T.
3′ MORRIS, motor on arm, 9½″ col.
3′ AMER., motor on arm, 6″ col.
2½″ AMER., No. 4 M.T. 9″ col.

Pract. new 5000 AMP. HANSON VAN WINKLE PLATING GENERATOR, with motor, exciter, chromium plating tank.

Pract. new 5000 AMP. HANSON VAN WINKLE PLATING GENERATOR, with motor, exciter, chromium plating tank.

GRINDERS
No. 5 BRYANT INTERNAL, New 1937, Oil Pump, M.D.
No. 39 EXCELLO INTERNAL THREAD GRINDERS, New in 1942. M.D.
No. 2 NORTON UNIV. TOOL & CUTTER.
12x48″ MATTISON HYD. FEED SURF. GRINDER.
8″x24″ COVEL HYD. FEED SURF. GRINDER.
No. 2 6x18″ R. & R. SURFACE.
No. 3 ABRASIVE SURF., 6x22″ table.
No. 78 WILMARTH & MORMAN SURF., 6x18″ cap.

LATHES

Practically New Toolroom Lathes

12″x30″ Model C MONARCH — 22″x48″ LODGE & SHIPLEY
16″x30″ Model C MONARCH. — 20″x48″ MONARCH

30″ AMER., Grd. Hd., 40″ swing.
22″x8′ LODGE & SHIPLEY, Grd. Hd., 22½″ swing.
16/20″x32″ L & S FLOOR LATHE, Grd. Hd., Q.C.G., Motor in base.
16″x10′ HENDEY FLOOR LATHE, Grd. Hd., Q.C.G., Mtr. in base, T.A.
16″x6′ LEHMAN HYDRATROL, Grd. Hd., Q.C.G., Motor in base.
14″x8′ SPRINGFIELD 12 Spd., Grd. Hd., Q.C.G., 16″ swing.
No. 4-A W & S UNIV. TURRET LATHE, Grd. Hd., 8¼″ hole, M.D. 24″ chuck.
Pract. New No. 4 UNIVERSAL TURRET LATHE.
Pract. New 4F "FASTERMATIC" CHUCKING MACHINE, 35½″ swing.

MILLING MACHINES
Pract. new No. 2-MH CINCINNATI PLAIN MILL, Grd. Hd., Timken Bearings, Rapid travers, 10½x52½″ table; Motor in base. Dial feed.
Pract. new No. 2 VAN NORMAN PLAIN MILL, Grd. Head, Timken Bearing spindle, Rapid traverse, Motor in base; 12x50″ table; Coolant pump.
No. 9-J GORTON VERTICAL MILL, 10½x35″ table, M.D.
No. 2 CINCI. VERT. MILL, Adj. hd., A.C., Mtr. in base, 12x52″ table, DL type.
No. 2-K K & T VERT. Mtr. in base, Adj. Grd., H.D. Dial Type.
Pract. new 18″ CINCINNATI PLAIN MFG. TYPE MILL, New 1941, Grd. Head, 7¾″x26½″ table; Coolant pump, M.D.
No. 36 DEVLIEG ELECTRIC TOOL PRODUCTION MILL, B. G., 15x66″ table; A.C. motor in base; coolant pump.
Pract. new 4″x9″ HANSON WHITNEY THREAD MILLS, New 1941, 33″ bed, 9″ bet. centers, Air chuck, coolant pump, A.C. M.D. (3)
No. 9 U-3 NATCO 3-WAY HYDRAULIC DRILLING & BORING MACHINE, New 1942, 1¾″ hole; each head. Individually driven.
FOX HORIZ. HYDRAULIC BORING & DRILLING MACH'S, New 1941.
FOX VERTICAL HYDRAULIC BORING & DRILLING MACHINES, New 1940.

PLANERS
48″x40″x17′ CINCI., Widened Pattern, 2 heads on rail.
48″x48″x10′ GRAY, 2 heads on rail.
CINCI. OPENSIDE SHAPER PLANER, one swivel head on rail, M.D.

SCREW MACHINES
1″ FOOTE BURT 6-SPINDLE SCREW MACHINE, M.D. New 1941.
⅞″ 4-SPINDLE NEW BRITAIN, Threading Spindle, Late Type, with chip conveyor & reel, new 1938.
1⅜″ MODEL AA CLEVELAND SCREW MACHINES, Single Spindle M.D. (2)
No. 2G & No. 0G BROWN & SHARPE.

SHAPERS & SLOTTERS
Pract. new 32″ OHIO, B. G., M. D.
Prace. new 28″ ROCKFORD HORIZ. HYD., 14x28″ table, M.D.
24″ AMER., 16x22″ table, M.D.
24″ G & E, 16x17″ box table, M.D.
16″ GOULD & EBERHARDT.
Pract. new No. 7A DOUGLAS VERTICAL SLOTTER, 7″ str. ,M.D.

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BILLINGS & SPENCER B-2 Diametic—Latest
BROWN & SHARPE #4, Latest Type
CLEVELAND ⅜" to 2½" Model A
CONOMATICS 3½" 4 spindle—latest type
NATIONAL ACME 9/16" mod. C, 5 spdle., M.D.

BORING MILLS—Horizontal

DETRICK & HARVEY—5" bar—floor type—motor drive
FRANKLIN 4½" bar, single pulley drive
GIDDINGS & LEWIS #25—2⅜" bar, M.D.
LANDIS #35—3½" bar—floor type
LUCAS #31—3" bar—motor drive
LUCAS #32—3¾" bar—motor drive
LUCAS #43—5" bar—motor drive
NILES BEMENT POND 5½" bar—M.D.
NILES BEMENT POND 5", 6", 7" bar—floor type
OHIO #5F-420 5" bar, floor type, latest type
P & H #10, 3½" bar, floor type, M.D.
PETRICK 3½" bar, floor type, M.D.

BORING MILLS—Vertical

BETTS 120"—2 swivel heads, motor drive
BULLARD 24", 36", 42" New Era Type, M.D.
BULLARD 86"—2 swivel heads—motor drive
COLBURN 72" 2 swivel heads, AC, M.D.
KING 30" Vert., M.D.
KING 62" 2 swivel heads, PRT, AC, M.D.
NILES 42"—2 swivel heads; power rapid traverse
NILES 73", 100", 2 swivel heads, PRT, AC, M.D.

DRILLS

BAKER #121 Single spindle—latest type
BARNES #H3, Hydram, latest type
BARNES #210—single spindle—latest
BAUSH #2, Multiple spindle, M.D.
BODINE 42-20, 42-30 automatics—M.D.
COLBURN #14, 2 spindle, heavy duty, AC, M.D.
EDLUND #1B, #2B, #2MS, M.D.
FOOTE BURT SIPP #2, #3—single spindle—latest
HENRY & WRIGHT 2 spindle
PRATT & WHITNEY No. ½Bx50" 2 spindle. Deep Hole—latest type

DRILLS—Radial

AMERICAN 4'9"—4'11"—5'11"—5'13" A.C., M.D.
BICKFORD 5'13", AC, M.D.
CANEDY OTTO 3'11" New
CARLTON 6'17", latest type
CARLTON 4'13", 5'14", 6'15"—M.D.
CINCINNATI BICKFORD 4'11", 4'13", 6'15", 6'19", latest type
DRESES 4'13", 5'15", AC, M.D.
FOSDICK 5'14", AC, M.D.
MORRIS 3½'9", AC, M.D.
MUELLER 4½'9", AC, M.D.
NILES BEMENT POND 6'15" uni., AC, M.D.
RYERSON 4'11", AC, M.D.
WESTERN 3', 4'18", 5'18", 6'20", latest type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber—latest
BARBER COLMAN type S, #3, #12 Hobber, M.D.
BROWN & SHARPE #3H gear cutter, M.D.
FELLOWS #7, #7A type, all models, latest
FELLOWS #6, #6A type, all models, latest
GLEASON—12" bevel gear generator—latest
GLEASON #13 tester, M.D.
GLEASON 15" Quenching Press
GLEASON 24" Bevel Gear Planer
GLEASON 18" bevel gear generator
G & E #96H Gear Hobber, with differential
GOULD & EBERHARDT #18H Hobber—M.D.
PRATT & WHITNEY 10" Grinder, hyd. latest type

GRINDERS—Cyl.—Plain & Uni.

BROWN & SHARPE #1, #2, #3, #4 Univ., motor drive—latest type
BROWN & SHARPE #5 plain, 3x12, latest type
LANDIS 6x18, 6x20, plain, M.D.
LANDIS 6x30 Plain Type "C," Hyd. latest
LANDIS 10x24 — Universal — Type "C" — Hyd. — Latest
NORTON 10x18 Plain—motor drive
NORTON 10x36" Plain Type C, Hyd., latest type
NORTON 16x72 Plain, Type C—latest type

GRINDERS—Internal, Cutter and MISCELLANEOUS

BROWN & SHARPE #10 Tool & Cutter—latest
BRYANT No. 16—16" Chucking—Internal—latest
BRYANT #5 Internal, hyd., latest type
FITCHBURG Uni., spline shaft, hyd.
GLEASON #12 cutter grinder
HEALD 72A3 Sizematic internal, latest type
HEALD 72A5 plain internal dial type, latest type
LEBLOND #2 uni., tool and cutter, latest type
PRATT & WHITNEY Contour Cutter—latest type
SELLERS #1 Tool—Motor Drive
SELLERS #2 Tool—Motor Drive
SELLERS #4T Uni., Tool—latest type

GRINDERS—Surface

ABRASIVE #3 22x8x12, M.D.
ARTER 8" Rotary Surface
ARTER 30" Rotary Surface—Hydraulic—latest type
ARTER Automatic Piston Ring
BLANCHARD #16A—Dial Type—motor drive
BLANCHARD #18-30" chuck—latest
BLANCHARD #27—42" Chuck—Latest
GALLMEYER & LIVINGSTON #35—8"x24"—Hyd.
MATTISON 12x16x48—Hyd.—latest
MATTISON 14x16x36—Hyd.—Latest
MATTISON 14x16x60—Hyd.—Latest
NORTON 10x36—Hyd.—latest

LATHES—Engine & Mfg.

AMERICAN 36x25' centers—Timken Bearing—2 carriages P.R.T. Taper Attachment—Latest Type
AMERICAN 42x17' bed, motor drive
BRIDGEFORD 36"x28', 36"x32', 36"x35' bed—2 carriages, M.D.
HARDINGE TR59—latest
HENDEY—12x54 centers—Mfg.—latest type
HOUSTON, STANWOOD & GAMBLE 42x25' bed
LeBLOND 13"x4' bed, 17"x14' bed, 20"x48" centers, Timken Mfg.—latest
LODGE & SHIPLEY 14x30" centers, Timken, latest
LOSWING 4x34, 4x60, 8x34, 8x108, 8x60—Timken Bearing—latest type
LOSWING 5x34" Model LR Auto. Timken, latest
MONARCH 12x30" centers—Timken—latest
NILES 48x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
NILES 60x10' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
NILES 60x15' centers—heavy duty—Timken Bearing P.R.T.—Latest Type
PITTSBURGH 50'x30' bed—M.D.
PRATT & WHITNEY—12x30" centers—Timken
PRATT & WHITNEY 16x30" centers, Timken, latest
REED PRENTICE 14x30" centers, Timken, latest
RIVET #918—latest
SPRINGFIELD 16x30" centers, 16x54" centers, Timken—latest

LATHES—Turret

GISHOLT #3, #4 Univ., Timken Bearing—latest
GISHOLT #3D Simplimatics—Timken—latest
GISHOLT #4L, 9" hole—cross sliding turret—Timken Bearing—latest type
GISHOLT #1L, #2L, uni., Timken bearing, latest
JONES & LAMSON #3, #5, #7C Univ., l atest type—Timken Bearing
LIBBY #1H-5 Timken Bearing—latest 5½" hole
BARDONS & OLIVER #3, #5, #7 Timken Bearing—latest type
CINCINNATI ACME #1, #5W, Timken bearing, latest type
MOREY #G, #3, #4, Timken Bearing, latest
WARNER & SWASEY #3, #4, #5, Uni., Timken bearing, latest type
WARNER & SWASEY 1A, 4A, Uni., Timken bearing—latest type

MILLING MACHINES—Mfg.

BRIGGS Type 2A, production, HYD, latest type
BROWN & SHARPE #12 auto., Timken—latest
CINCINNATI 4-36 Hydro. Timken Bearing—latest
CINCINNATI #0-8 Vert.—Pl. Auto.—Timken Bearing—latest type—Rise & Fall
CINCINNATI #1-12, #1-18 Plain Auto.—Timken Bearing—latest type
CINCINNATI 48" duplex, automatic, SPD

Nearly All Built After 1941

KEARNEY & TRECKER #1218 Auto.—Timken Bearing—latest type
MOREY #12M 2 spdle. Profiler & Milling Machine
NICHOLAS hand, M.D.—latest type
OHIO Auto. 16"x72" table—Timken Bearing

MILLING MACHINES—Plain

CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #2 Dial Type, Timken—latest
CINCINNATI #4S, #5, high power, M.D.
KEARNEY & TRECKER #3K, Timken—latest
KEMPSMITH #4 Maximiller—Timken—latest

MILLING MACHINES—Univ.

AMES Bench, Timken Bearing, latest type, M.D.
CINCINNATI #2, dial type, Timken—latest
KEARNEY & TRECKER #3H—Timken—latest
ROCKFORD #2B—Motorized

MILLING MACHINES—Vertical

BROWN & SHARPE #5—motor drive
CINCINNATI #2, #4—Dial Type—Timken—latest
KEARNEY & TRECKER 2H, 2K, 3H, 3K, 4H, 4K, Timken—latest

PLANERS

CINCINNATI 24" Crank—Motor drive
CINCINNATI48x48x20', 3 heads, AC, M.D.
CINCINNATI 36x36x8', 2 heads, AC, M.D.
CHANDLER 36x36x20', 4 heads, AC, M.D.
CLEVELAND 48x48x16'—Openside—3 heads—M.D.
DETRICK & HARVEY 48x48x10', 12', open side
DETRICK & HARVEY 48x48x16' 4 heads, Hyd.
GRAY—48x48x16'—4 heads—A.C.—M.D.
GRAY 54x42x10', 2 heads, AC, M.D.
GRAY 60x48x16', 3 heads, AC, M.D.
HAMILTON 42x42x20', 4 heads, motor drive
LIBERTY 36x36x8', 3 heads, AC, M.D.
LYND FARQUHAR 26" Openside, motor drive
NBP 36x36x10' 3 heads, DC, M.D.
NBP 42x42x12', 2 heads, AC, M.D.
NBP 48x48x14', 16, 2-4 heads, AC, M.D.
NBP 54x54x12', 2 heads, box table, AC, M.D.
NILES 48x48x12'—Time Saver—3 heads, P.R.T., box table, D.C., M.D.—latest type
NILES BEMENT POND 96x80x20' box table, 4 heads, Hyd., PRT—motor drive
OHIO 42x42x20'—2 heads, AC, M.D.
PATCH 48x48x14', 4 heads, DC, M.D.
POND 48x48x16', 2 heads, AC, M.D.

SAWS

BRIDGEPORT #48W Abrasive
CAMPBELL #213, 401, wet abrasive, latest
GROB #OS-200 band, latest type
MOTCH & MERRYWEATHER #3 Cold Saw—Hyd.—latest type
PEERLESS 14x14 Hack; latest type

SHAPERS

COCHRANE BLY Univ. Vert. Shaper-Miller; M.D.
LAMAIRE 18' Vert. Hydraulic—latest type
MOREY 10", 14" Vertical—latest type
NEWTON 15" vert. slotter, DC, M.D.
NILES 18" ver. slotter, DC, M.D.
PRATT & WHITNEY 6', 10" Vertical, Motor drive
ROCKFORD 24" Hyd.—latest

THREAD MILLING MACHINES

MOREY SHIELDS 12x120, 12x192—latest type
PRATT & WHITNEY 4½x12, Model C—latest
PRATT & WHITNEY 6x132—motor drive

MISCELLANEOUS

BARNES #2—single spindle—hone—Latest Type
BAUSH Radial Tapper—latest
BILLINGS & SPENCER 200, 400, 800 lbs. board drop hammer, latest type
FERRACUTE No. DG55, Drawing, latest type
FISCHER #1 Oil Groover, M.D.
LANDIS ¾" Bolt Threader—latest
LaPOINTE #3L Broach, horiz. hyd. 15 ton cap.
LeBLOND #2 horiz. Hone SS, latest type
LeBLOND #2 deep hole borer, latest type
MORTON 60" Combination traveling head planer, milling and drilling motor drive
NILES 30"x50' deep hole borer, Timken—latest
PRATT & WHITNEY 3-B Jig Borer—Latest Type
TREADWELL 12"—Pipe Threader—Motor Drive
WHITON 8x108 centers duplex centering, M.D.
YODER Multiple tube cutting machine—latest

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POWER PRESSES

AIR HYDRAULICS—2½ TON CAP. NEW.

Make	Tons	Die Space	Stroke	Shut	Type
(20) V & O #0	5	13"x 12"	2½"	7"	OBI Dial Feed
(20) V & O #2	17	12"x 18"	2½"	11"	OBI Dial Feed
(22) Hercules #32 (about)	15	10"x14½"	3"		"C" Frame Hopper Feed
(23) Wat Farrel (about)	15	12"x 18"	3"		"C" Frame Dial Feed
Bliss #172A	22	5"x 4"	1½"	7"	End Wheel
Bliss #20	30	14"x 22"	3"	8"	OBI
Bliss #68C	35	21"x10½"	1-2½"	7"	Arch-DA
(3) Mystic #5A	40	14"x 17"	6"	14"	Embossing & Moulding for Plastics
Wat-Far	60 Tons 6 Plunger				Eyelet, Heavy Duty

Make	Tons	Die Space	Stroke	Shut	Type
Torrington	40	23"x 16"	1-2"	6¼"	SS-DA
Bliss #1B	43	14"x 26"	3-6"	8½"	SS-DA, Gap
(2) Bliss #52	45	14"x 15"	2"	9½"	SS-DA
(2) Consolidated #54	60	18"x 18"	3"	12"	Trimmers-Shear
Bliss #57	75	18"x 18"	2"	11"	SS Trimming
(2) Bliss #7	180	28"x 38"	1½-4½"	15"	SS-DA, Geared, Air Clutch
Toledo #59½s	500	31"x 31"	8"	29"	SS-DA, Twin drive
Lake Erie Hydraulic	2500	133"x120"	38"	42"	PBX Pump & Motor 1944

BRAKES

Press, Geo. Ohl 10½'x10 Gauge

D & K Apron type, 8'x16 g. power

SHEARS

Power, Bliss 42"x11 g. Bliss 24"x3/16

Niagara 6'x10 g.

Ohl 8'x¼"

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MDNA MEMBER

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BLISS 304—58 ton, 8" stroke, 18"x18" bed

BLISS 4½—75 ton, single and double act. 1½-4½" stroke, 21"x31" Bed

BLISS 6—125 ton single and double act. 2-5" stroke, 24"x31" Bed

BLISS 7—180 ton, single and double act. 1½-4½" stroke, 24"x36" Bed

BLISS 7—88 ton, 4-8" stroke, Horizontal Horning

BLISS Hydro-Dynamic 100, 150, 200 ton adj. stroke, 30"x31" Bed

BLISS 88—226 ton, 10-36" stroke

BLISS 25A—600 ton knuckle

BLISS 26A—800 ton knuckle

BLISS 27—1000 ton knuckle

CLEVE 14S—180 ton, 8-30" stroke

CLEVE 8K—800 ton knuckle, 6" stroke

CLEARING K 1800—42, 800 ton knuckle 6" stroke

TOLEDO 59½S—504 ton, 8" stroke 31"x 31" bed, twin dr.

W & F 6600-6" stroke, 10 sta. trans. slide, 3"x15" Bed

Ceco Stamps—24x48, 36x48, 48x48, 60x156

Pneumatic Drop Hammer 36x48 3000# Head

Hydraulic Presses 75 ton to 5000 ton

100,000# Draw Bench for 40 ft. tube, single, double, triple heads

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2 Landis ¾" Bolt Formers and Threaders, M.D.

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Woodward & Powell 42" x 42" x 36 ft. 4 Head Planer

Cincinnati 36" x 36" x 16 ft. Planer, M.D.

1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

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OTT MACHINERY SPECIALS

AUTOMATICS, Acme-Gridley 6 spdle, 9/16" & 2⅝"
AUTOMATICS, Gridley, 9/16" & ⅞" Model G
AUTOMATICS, #11 Polymatic Form & Cutoff
AUTOMATICS, #1 Wickman Swiss Type, used very little
CONOMATICS, 2⅝—8 spindle, M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
LATHES, Hendey, E.B.M. type, 14"x7' M.D.
LATHES, Rockford, 16"x8' Geared Head, M.D.
MILLING MACHINES, Milwaukee #1B Universal #2, Plain, M.D.
NIBBLERS, Savage & Campbell
PRESS, DD654 Ferracute, D.A.
THREAD ROLLER, Watson-Flegg. Late type—3/16" to 2⅛" cap.

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CADILLAC 3103

MDNA MEMBER

LATE TYPE

5' CINCI. BICKFORD RADIAL DRILL

New 1942, 17" col., 2 way base, AC motors, coolant system, elec. col. clamp; M.D. P.R.T. to head, 19,500 lbs.

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DRILL, RADIAL—FOSDICK, 3½". G.B., M.D.
KEYSEATER—MITTS & MERRILL No. 6, M.D.
MILLER, PLAIN—MILWAUKEE No. 2-B Double Over-arm, M.D.
PLANER, MEAL—WOODWARD & POWELL 30"x30"x8' 1 rail head, 1 side head
TURRET LATHES—FOSTER No. 1-B Univ. inc. 2 Wrenchless Chucks, etc. M.D.; also W & S No. 2-A Univ.

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84"x52' Putnam Geared Head Motor Drive —Equipped with 2 carriages—Inspection in Operation.

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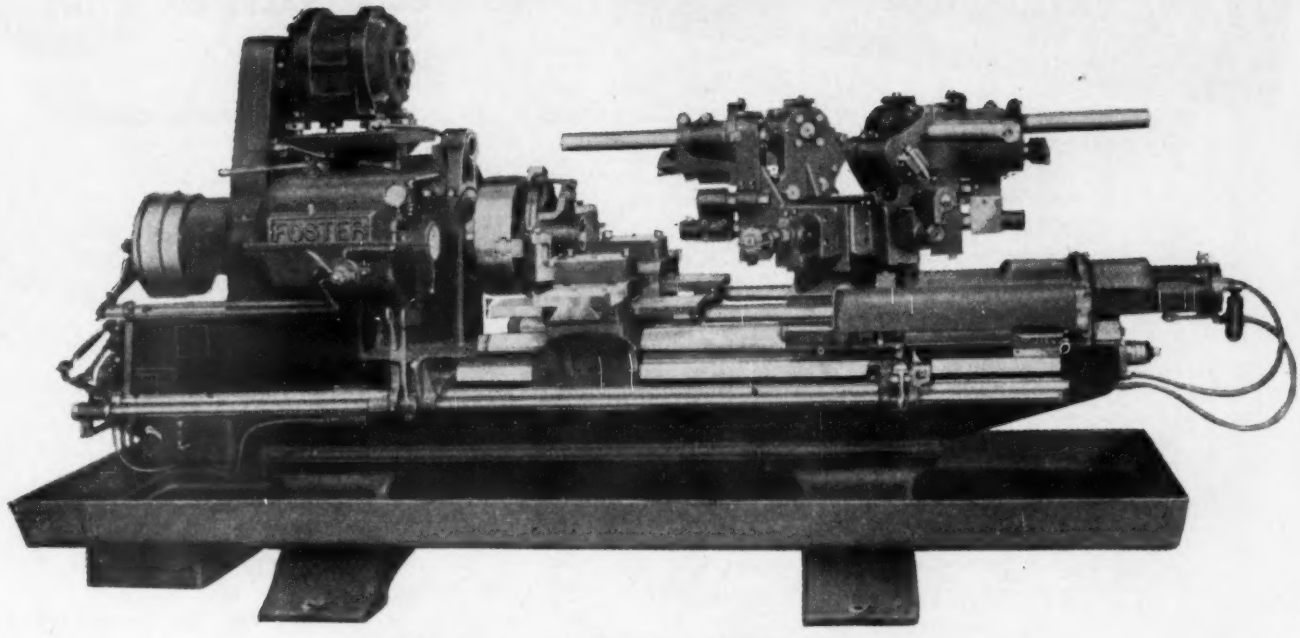
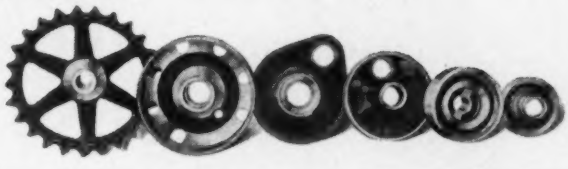


3-F • 4-F FOSTER

FASTERMATICS

TURRET TYPE — Slightly Used

With these machines, at our prices, you can machine your parts faster, cheaper, accurately. Simple to operate. No skilled operators required. Ready for operation. No waiting for motors—they are on the machines now. Many tools are with these machines—no extra cost. Check with the manufacturer or we can show you how to cut your costs and increase your output with these machines.



ARE YOUR JOBS SIMILAR TO THESE:

Gear Blanks, Bearing Sleeves, Shafts, Large Sprockets, Ring Gears, Retainer Rings, Steel Hub Caps, Cylinders, Chuck Bodies, Bell Housings, Fly Wheels.

★

SPECIFICATIONS

	3-F	4-F
SWING		
Over bed	27 1/2	35
HEAD		
No. of spindle speeds	12	12
Dia. hole thru spindle	3 3/4	5 1/8
Center of spindle to top of ways	11 1/2	13 1/2
CROSS SLIDE		
Width of cross slide	9	10
Length of cross slide	19 1/2	25
Max. travel-cross	3 5/8	6
TURRET		
Dia. across flats	15	20
Dia. tool holes	3 3/4	5
Max. dist. Sp. nose to tur. face	41 5/8	59 1/2
Effective turning mount	12	18
Width of bed—C to C of Vees	16	24

EMERMAN MACHINERY CORP.

875 W. 120TH STREET — CHICAGO 43, ILLINOIS

BOTWINIK BROS., INC.

LIST OF

Used & Guaranteed Rebuilt MACHINE TOOLS

HAVE YOUR NAME PLACED ON OUR MAILING LIST

FOR SPECIAL SALES BULLETINS

DRILLS

Avey & Allen 3, 4, 5, & 6 Sp.
Cincinnati-Bickford 3', 4', 5' & 6' Radials.

GRINDERS

Brown & Sharpe No. 2 Surface Meter-in-Base.
B. & S. Nos. 1, 2 & 3 Univ.
Abrasive Nos. 33 & 34; No. 3B
Norton 6"x18" Hyd. Surface
Norton 6"x10"x36" Surface
Norton 15"x15"x72" Surface
Norton 6x32, 10x24, 10x50 Plain
B. & S. Nos. 10, 11, Plain
Bryant, Nos. 3B, 5, 6, 12 Internal
Heald, No. 70-A, Internal
Landis 12"x32", 20"x120", 20"x144" Plain
Cincinnati No. 1½ Tool & Cutter
LeBlond No. 2 Tool & Cutter
Norton No. 2 Tool & Cutter
Cincinnati No. 2 & No. 3 Centerless
Cincinnati No. 3 Centerless Lapper
Fitchburg 36" Spline Grinder
Blanchard No. 16—30"
Blanchard No. 18 Rotary Surface
Heald No. 25-A Rotary Surface
P. & W. 14" Vert. H.B.
Barber-Colman No. 3 Hobber & Grinder

LATHES

Hendey 14"x6' Y.H.
American 16"x6'—G.H.
Lodge & Shipley 20"x8', G.H.

MILLERS

Brown & Sharpe No. 2 Lt. Type Plain
Milw. No. 2B & 3B Double Overarm
K. & T. No. 5H Plain
B. & S. No. OY Production
Cin. No. 2 Plain; Nos. 3, 4 Vert.
Becker Model C, Vertical
Becker No. 7H, Plain
B. & S. No. 3B & 5B Plain
Rice-Barton 4" Spline
P. & W. 8", 10" & 12" Automatic
Cincinnati 18" & 24" Production
Sundstrand No. 1-18 and No. 2 Electromil.
P. & W. 6x14 & 6x72 Thread
Lees-Bradner 6"x36" Thread

PLANERS

Cincinnati—48"x48"x20' 3 Head
Powell 48"x48"x12', 4 Head

SCREW MACHINES

B. & S. Nos. 00, 0, 2 Automatics
B. & S. Nos. 1 & 2 Hand Screw
Potter & Johnson No. 6-C Chuckers
Cleveland 1⅜" Model AA.
W. & S. Nos. 1, 2, 2A, 3A Universal
Foster, No. 7 & No. 1B
Cone 1¼" 4 Spindle
Cleveland 3¼" Model A.
Cone 3½"—4 Spindle
Cleveland 6¾", Model A.
Cleveland 7¾", Model A.
Gridley ⅞", 1¼", 1¾" & 2⅜" Model C; 3¼" & 4¼"

MISCELLANEOUS

Borematic—Heald No. 47-A.
Boring Mill—Gisholt 30"
Boring Mill—Bullard 36" & 42" New Era
Boring Mill—Bullard 100" Head
Cutoff Machine—Abrasive No. 213
Fay Automatic
Fellows Gear Shaper No. 7
Hammers—Bradley
Hammers—Billings & Spencer & Chambersburg Board Drop, 600 lbs.
Rack Shaper—Fellows 4"x72"
Slotter P. & W. 6" Vert.
Trimming Mach. V. & O. No. 202½

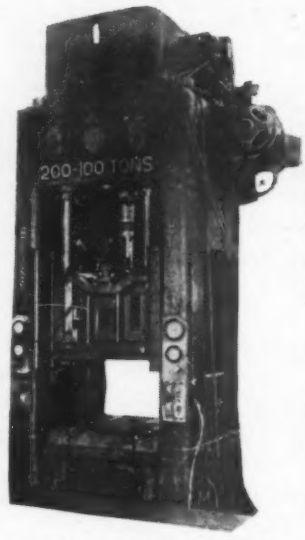
EXPORT DEPARTMENT, 44G WHITEHALL ST., NEW YORK 4, N. Y.

MONA MEMBER

BOTWINIK BROS. Inc.

373 WELTON STREET, NEW HAVEN 9, CONN.

America's Foremost Machine Tool Rebuilding Plant



Bliss 200 ton d.a. hydro dynamic 44"x32" stroke Bed 49"x38". Will draw and lift out 17".

PLAY SAFE WITH EVEREADY

MODEL	TONS	STROKE	SHUTHEIGHT	BED
Henry & Wright	15	4½"	11⅜"	30x15
Bliss #304	60	2½"	11⅜"	18½x18½
Bliss #4½	70	1½x4½"	11x14½"	21x27
Bliss #6	125	2x5"	9x11"	30x24
Z & H #16	250	16"	11"	21x21

Clearing Presses from 75 to 800 ton.

HYD. PRESSES: Lake Erie presses from 75 to 200 ton.

Baldwin Southwark 200 ton 21" stroke, 3' bet. tie-rods.

Elmes 300 ton, 66" stroke, 22" shutheight.

BERTSCH BENDING ROLL—4' cap., 1" max. plate

KLING 60" BENDING ROLL—max. cap. 3" thick mild steel.

AETNA STANDARD—plate bending machine, 4 roll type. Capable of handling steel ¾" thick. Brand new.

EVEREADY SUPPLY COMPANY
803 HOUSATONIC AVENUE BRIDGEPORT 4, CONN.

MACHINE TOOL BARGAINS

HEALD No. 72 and No. 70A Internal Grinder

NORTHERN Heavy Duty 40" Precision Internal and External Grinders

NEWTON 4' Vertical Rotary Milling Machine

INGERSOLL 34"x48"x10' Double Housing Planer Type Milling Machine

All machinery in excellent condition and capable of holding new machine tolerances. May be inspected at our plant.

NORTHERN PUMP COMPANY
MINNEAPOLIS 13 MINNESOTA

5" AJAX UPSETTER, M. D.

AARON MACHINERY CO., INC.
45 Crosby Street New York, N. Y.

Defiance #6 horizontal boring mill, 4½" bar.
Lucas #31 horizontal boring mill, 3" bar.
Hydraulic car wheel press 6 ft.
36"x36"x12' Woodward & Powell 3 head planer.
Bement steel plate shear, 14" blade.
8 ft. Pyramid type bending rolls.
#5 Cincinnati plain miller, spd.

Johnson Machinery Company
222 Market Street, Newark 2, N. J.

B. & S. No. 2B heavy plain miller. K & T No. 2 B S Plain miller, both geared head, s.p.d. Rebuilt 30-day guarantee. Producto automatic miller, motor in base, latest type used 60 days. Covel surface grinder, motor in base, latest type used 90 days. 30-day guarantee with each.

SMITH MACHINE TOOL CO.
SPENCER & JACKSON STS.
ALBANY, N. Y.

Eastern Rebuilt machine tools are GUARANTEED to meet TEST SHEETS

MORE THAN 2000 MACHINE TOOLS READY TO SHIP *NOW!*

For more than forty years, no rebuilt machine tool has ever left Eastern's specialized rebuilding shop until it has met the *original manufacturers "performance under power" tests.* It is your assurance that when you buy from *Eastern* you are getting the exact output and efficiency originally designed into the machine you need.

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 0S Cincinnati, with rise and fall attachment, m.d., latest
No. 1M Cincinnati, m.d.
No. 1A Milwaukee, m.d. in base
No. 1½ Cincinnati, cone
No. 2 Cincinnati, cone
No. 2 Cincinnati High Speed Dial Type, m.d. in base, latest
No. 2HL Milwaukee, m.d. in base, latest
No. 2MH Cincinnati, m.d. in base, latest
No. 2B Brown & Sharpe, m.d. in base, latest
No. 3B Brown & Sharpe, m.d.
No. 3B Brown & Sharpe, m.d. in base, latest
No. 3S Cincinnati, m.d.
No. 4 Cincinnati H.P., m.d.
No. 4B Brown & Sharpe, m.d.
No. 4 Cincinnati H.S. Dial Type, m.d., latest
No. 4S Cincinnati, m.d.
No. 5B Heavy Brown & Sharpe, m.d.
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 Cincinnati H.P., m.d., latest

VERTICAL BORING MILLS

24" Bullard Spiral Drive, m.d., with side head
24" Bullard New Era, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Colburn HD, 2 swivel heads
48" Putnam H.D., m.d., 2 heads
48" Cincinnati Rapid Production, m.d., 1 turret, 1 swivel head
52" King, m.d., 2 swivel heads
53" Niles, m.d., 2 swivel heads
54" Bullard Spiral Drive, m.d., with side head, latest
54" Colburn H.D., m.d., 1 turret, 1 swivel head
72" Colburn H.D., m.d., 2 swivel heads
84" Niles H.D., m.d., 2 swivel heads
100" Niles H.D., m.d., 2 swivel heads

PLANERS

24"x24"x6' Pond, 1 head, belt
30"x30"x10' American, 1 head, belt
30"x30"x10' American, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' G. A. Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x12' Powell, 2 heads, belted m.d.
36"x36"x16' Gray, 2 heads, belted m.d.
36"x36"x18' Niles-Bement-Pond, 2 heads, reversing m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray, 2 heads, belt
38"x38"x20' Gray Spiral Drive, 2 heads, belt
42"x42"x26' Cincinnati, 4 heads, belted m.d.
48"x48"x15' Detrick & Harvey, reversing m.d., 4 heads
48"x48"x28' Cincinnati, 4 heads, reversing m.d.
48"x48"x30' Cincinnati, 4 heads, belted m.d.
48"x48"x40' Sellers, 2 heads, reversing m.d.
50"x48"x32' Niles-Bement-Pond, 4 heads, reversing m.d.
66"x60"x40' Niles-Bement-Pond, reversing m.d., 4 heads
72"x72"x24' Niles-Bement-Pond, 4 heads, reversing m.d.
72"x72"x36' Niles, reversing m.d., 4 heads
96"x72"x18' Niles, 4 heads, belted m.d.
120"x120"x20' Mesta, 4 heads, m.d., latest

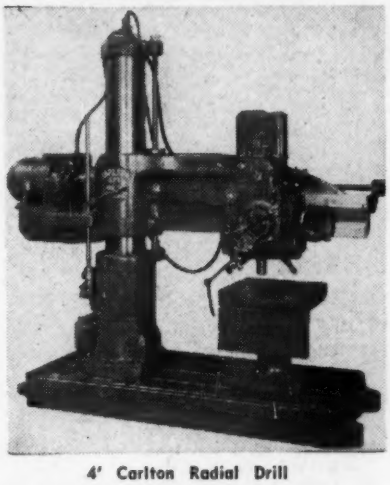
GEAR MACHINERY

Model T Barber-Colman Gear Hobber, m.d., latest
No. 12 Barber-Colman Double Overarm Gear Hobber, m.d.
No. 18H Gould & Eberhardt Gear Hobber, m.d.
No. 34 Brown & Sharpe Gear Hobber, m.d.
No. 44 Brown & Sharpe Gear Hobber, m.d.
No. 6I Fellows Gear Shaper, belt
No. 6HS Fellows Gear Shaper, m.d.
No. 6IA Fellows Gear Shaper, m.d., latest
No. 7A, 7IA Fellows H.S. Gear Shapers, m.d.
3" Gleason Straight Bevel Gear Generator, m.d.
8" Gleason Mfg. Type Straight Bevel Gear Generator, m.d.
12" Gleason Straight Tooth Bevel Gear Generator, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
10" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
No. 2HS Lees-Bradner Hydraulic Spur & Helical Gear Grinders, m.d.
11" Gleason Straight Tooth Bevel Gear Generator
No. 4-36" Brown & Sharpe Auto. Spur Gear Cutter
No. 6-60" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
No. 13LS Fellows Gear Lapper, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
48" Cleveland Gear Hobber, m.d.
Cincinati Gear Burnisher, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
Schuchardt & Schutte Gear Tooth Rounder, belt

RADIAL DRILLS

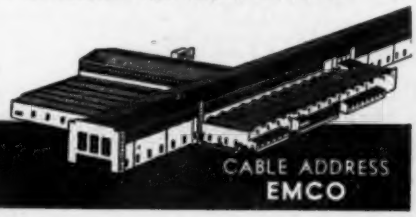
2½ Cincinnati-Bickford Super-Service, m.d. on arm, latest
3' American Sensitive, belt
3'-11" American Triple Purpose, m.d. on arm
3'-11" American Triple Purpose, m.d. on arm, lengthened to 4'
3'-11" Carlton, m.d. on arm, latest
3' Fosdick Sensitive, belt
4'-11" American Hole Wizard, m.d. on arm, latest

RADIAL DRILLS



4' Carlton Radial Drill

4'-11" American Triple Purpose, m.d.
4'-11" Carlton, m.d. on arm, latest
4'-13" Cincinnati-Bickford Super-Service, m.d. on arm (4 in stock)
4'-13" Cincinnati-Bickford, gear box on base
4' Fosdick, gear box
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col.
5'-17" Cincinnati-Bickford Super-Service, m.d. on arm
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Prentice, motorized
6'-15" American Triple Purpose, m.d. on base
6'-15" Carlton, m.d. on base
6'-17" American Hole Wizard, m.d. on arm, r.r. type base, latest
6'-15" Cincinnati-Bickford Full Universal, m.d. on base
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-15" Cincinnati-Bickford, m.d. on base
8'-16" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm



THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1241
CABLE ADDRESS EMCO

LOOK THROUGH THIS LIST

AUTOMATICS

½" & 2" Cleveland Model B
12"x63" & 14"x19" Fay
14"x18" Monarch Magna-Matic
6"x6¾" Goss & DeLeeuw
No. 454 New Britain chucking
Gisholt simplimatic

BORING MILLS

100" Niles Bement Pond heavy pattern
96" Cincinnati Massive Pattern
60" Colburn
53" Niles Bement Pond
42" & 24" Bullard V.T.L.

DRILLS

4' Hammond sensitive radial
18" Walker Turner radial
No. OOS Natco
Garvin duplex
21"x74" Munson double end
4-spdl. #3 Leland Gifford
24" Kokomo upright
24", No. 25 Foote Burt Heavy Duty
34-spdl. #30 Natco

LATHES, TURRET

Nos. 4 & 5 Warner & Swasey universal
Nos. 3-B & 5 Foster universal
Nos. 3 & 5 J. & L. universal
16"x6' South Bend
Nos. 3 & 5 Foster
24" & 42" Bullard vertical
28" Gisholt
3"x36" Jones & Lamson

PRESSES

12 ton U.S. OBI
#10 Bliss straight side
8 & 20 ton General Flexible
35 ton Metalwood straightening
65 ton Watson Stillman straightening
500 ton Southwark hydraulic
1000 ton Lake Erie hydraulic

SHAPERS

16" Gemco (new)
20" American
24" Gould & Eberhardt
32" Morton draw cut

UPSETTERS

1" National
2½" National, latest type with air clutch & guided ram
3" National

MISCELLANEOUS

#16-D Moline cylinder borer
#112-C Ex-Cell-O precision borer
Nos. 1, 2 & 3 Sundstrand balancers
No. 3 Gardner buffer
1400 CU. FT. Sullivan compressor
173 cu. ft. Ingersoll compressor
Nos. 2 & 3 Cincinnati centerless grinders
No. H-1 Micromatic Hydrohoner
#211 Barnes honer
No. 1½ Baker keyseater
No. 9 LeBlond multi-cut lathe
6", 8" and 15" Sundstrand automatic stub lathes
#12-B Pratt & Whitney profiler
Cleveland sand cutter
6", #401 Campbell abrasive saw
Model J Radiac abrasive saw
#11-B Badger alligator shear
4" Stevens die slotter
16" Bement Miles slotter
#2 Garvin tapper
2" #22 Murchey threader
90 KVA Fisher body seam welder

SEND FOR COMPLETE LIST

MILES MACHINERY CO.
SAGINAW, MICH.

IN STOCK

LATHES

8"x108" Fitchburg Lo-Swing
12"x18" Lipe Carbo
18"x6' American Grd. Hd.
18"x48" Monarch, Keller attachment (1942)
20"x10" Lodge & Shipley Grd. Hd.
22"x48" Monarch, (1943)
36"x30' Lodge & Shipley Triple Geared Selective Head, two carriages
42"x18' Putnam Geared Head

MILLING MACHINES

#3 Milwaukee Vert. M.D.
#3K Milwaukee Vert.
No. 4 Cincinnati Plain, Motor Drive
No. 4K Milwaukee Plain Late Type
No. 118 Van Norman Production
24" Cincinnati Production
Taylor & Fenn Spline
No. 27MB Smalley General Thread
#2 Hanson-Whitney Thread
No. 6 Lees-Bradner Thread
26"x25"x12' Ingersoll Adjustable Rail
42"x36"x14' Ingersoll Adjustable Rail, four heads

DRILLS

No. 2-8 Spdl. Leland-Gifford
7' American full Universal Radial

VERT. BOR. MILLS

34" King
42" Bullard New Era Vertical Turret
72" King, Motor Drive

HOR. BOR. MACHINES

No. 50 Universal, 5" Bar, 60x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".

GEAR HOBBERS

No. 4 Pfauter, 72" Capacity

PLANERS

36"x36"x8' Woodward & Powell

TURRET LATHES

No. 2 American Brass Lathe
No. 2 Brown & Sharpe, Wire Feed
#3 W & S Univ. Bar Feed
#4 W & S Univ. Speed Selector
No. 1-A W & S Univ. Speed Selector
#4—W & S 1½" Screw Machine
#6—W & S 2" Screw Machine
#6R Denver Univ. 2-9/16" capacity
18" Libby—3½" Hole—M.D.

GRINDERS

6"x18" Norton Hydraulic Plain
6"x30" Norton Hydraulic Plain
23"x36" Norton Plain, M.D.
14"x168" Norton Plain, Late Type
#22—12" Heald Rotary Surface
10"x24" Landis Universal, M.D.
No. 6 Blanchard Surface, 26" chuck

HILL-CLARKE
MODERNIZED & MOTORIZED CYLINDRICAL GRINDERS

SIZES AVAILABLE

10x18	14x36	16x 50
10x36	14x50	16x 72
10x50	14x72	18x 96
10x72		24x 96
10x96		24x240

HILL-CLARKE MACHINERY COMPANY
651 Washington Boulevard
Chicago 6, Illinois

LATEST MODELS

No. RD1175J Walker Turner Radials, M.D. (4)
24" Cincinnati Box Col. Upright (1942)
3'11" American "HOLE WIZARD" Radial (1942)
3'11" Morris "MOR-SPEED" Radial (1942)
7'17" Fosdick Radial (1942)
24" Bullard Vert. Turret Lathe, Spiral Drive
36" King Vert. Bor. Mill, Side Head
72" King Vert. Bor. Mill, Side Head (1942)
#340-F Giddings & Lewis Mill (1942)
#2 K & T Rotary Head Die Miller (1943)
No. 1H-12 Kearney & Trecker Mig. Miller (1941)
#4 Cincinnati Pl. Miller (1942)
No. 5H Kearney & Trecker Pl. Miller (1941)
#4 K&T Vert. (1942)
No. 0 Brown & Sharpe Wire Feed (3)
No. 3 Warner & Swasey Univ. Turret, Timken (1941)
No. 4 Warner & Swasey Univ. Turret—1942 (4)
No. 5 Warner & Swasey Univ. Turret—1942
No. 5—2½" Jones & Lamson Univ. Turret —(1942)
No. 1A Warner & Swasey Turret, Timken (3) 1941
No. 2A Warner & Swasey Turret, Timken (2) (1941)
No. 11 Blanchard (2), (1942)
No. 18 Blanchard—(1942)
#10 B & S Cutter & Tool Grdr.
No. 4T Sellers Tool Grinder (never Used)
72A3 Plain Heald Internal Grinder, 3 motor drive for Tool Room—(1942)
4"x12" Landis Type H Plain Grinder, (1942)
14"x168" Norton Type C Plain Grinder, M.D. (1942)
13"x4' & 5' bed South Bend M.D. Lathes (3)
18"x72" Monarch "BB" Lathe raised to swing 24½" (1945)
22"x96" Monarch Model "M" Lathe (1944)
42"x132" Centers American Lathe, M.D. (1942)
50"x17' Centers LeBLOND Lathe, M.D. (1942)

Wigglesworth Machinery Co.
203 Bent St. Cambridge, Mass.

BORING MILL or VERTICAL TURRET

36" Bullard "New Era", with side head, form cutting and threading attachment. Serial No. 11177.

With or without motor. In very good condition. Immediate shipment.

GALBREATH MACHINERY CO.
Empire Building Pittsburgh, Pa.

KEEP POSTED WITH SIMMONS

BORING MILLS

9" Bar BETTS Horizontal floor type, 50" face plate, 8'—vertical travel, modern, 4-motors.

3" & 4½" Bar Universal TRI-WAY Horizontal Boring Mill, P.R.T.
No. 35 LANDIS Horizontal floor type
24" New Era, BULLARD
72" KING, Two Swivel Heads.
96" CINCINNATI, 2 swivel heads.
12' BETTS Heavy, Double Drive
14' BETTS (Consolidated) late type.
14-20' N.B.P. Extension type boring—2 swivel heads, all geared feeds
16' N-B-P 2 swivel heads.

MILLERS

24"x24"x16' INGERSOLL Planer type.
36"x36"x10' INGERSOLL Slab
Nos. 2 and 4 CINCINNATI High Power Vertical, Power rapid traverse.
No. 5 CINCINNATI Plain Rectangular overarm table 83"x21".
No. 3-36 CINCINNATI Duplex Hydromatic
6"x14" PRATT & WHITNEY, thread.
No. 3 KEMPSMITH Maximiller.
Nos. 3 and 4 CINCINNATI Plain.

LATHES

30"x18' AMERICAN 12 Speed, G.H.
36"x32' NILES, "Timesaver".
42"x34' LEBLOND late type
30"x34' LEBLOND Gun Boring.
48"x30' SIMMONS, Geared head.
60"x30' NILES Heavy Duty Geared Head, M.D. (Built 1942).
60"x40' Centers MACKINTOSH-HEMPHILL Heavy Duty Geared Head M.D. (Built 1942).
90" PUTNAM Driving Wheel Lathe with journal truing and Double Quartering
No. 2-H LIBBY, Full Universal Cross Feeding Turret, Taper Attachment, M.D.
3-AL GISHOLT, Hardened Ways.

DRILLS

8' AMERICAN Triple Purpose Radial, Motor-on-Arm, 230-V., D.C.
Nos. 310 & 314 BAKER H.S.

GRINDERS

No. 2 CINCINNATI centerless grinder.
24"x20' Centers NORTON Plain. Cylindrical individual motor drive to work spindle, wheel spindle and table.
20"x96" LANDIS, plain cylindrical.

GEAR HOBBERS

No. 5 Pfauter, spur, helical and worm, 130" dia. capacity.

100" GOULD-EBERHARDT, Hobber Horizontal, for spur, helical and worm gears, capacity diameter 101", face 48".

PLANERS

48"x48"x20' N-B-P 4 heads.
48"x48"x32' GRAY Spiral Drive, four heads.
72"x72"x15' N.B.P. 4 Hds, 230-volt.

14'x9'x35' Capacity Detrick & Harvey Convertible openside, 2 rail heads, 2 side heads, traveling outer support, 230 V.D.C.

60"x60"x18' CLEVELAND Openside.
84"x60"x18' DETRICK-HARVEY Convertible Openside, 230-volt, D.C.
120"x96"x20' CINCINNATI Rapid Traverse, 230 volt, D.C. reversing type planer motor and control, 4 heads.

SHAPERS—SLOTTERS

6" & 10" PRATT & WHITNEY Vertical.
15" BETTS Heavy Slotter
18" NILES-BEMENT-POND Heavy Slotter.
21" NILES-BEMENT-POND Slotter, M.D.
32" CINCINNATI crank shaper.
36" MORTON Drawcut, Rotating Arbor, Geared Feeds, P.R.T., M.D.

MISCELLANEOUS

30"x⅞" N-B-P Bending Rolls
No. 2 PRATT & WHITNEY Jig Borer with 22"x44" table.
60" NEWTON Cold Saw, M.D.
48" MORTON Keyseater
24'x1½" N.B.P. Plate Planer.

ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORPORATION
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N. Y. OFFICE: 50 EAST 42nd STREET, NEW YORK 17, N. Y.

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DRILLS

28" Cincinnati Bickford Sliding Head
32" Cincinnati Bickford, Sliding Head
6' American, Radial
4' Fosdick, Radial
Baush Multiple Spindle, 8—#3 M.T. Spindles

GRINDERS

#33 Abrasive, Surface
Model B Thompson, Hydraulic, 12"x24" Surface
#2 Cincinnati Centerless

LATHES

12"x6' LeBlond Geared Head
15"x6' Sidney
16"x6' Porter-McLeod Geared Head
17"x6' LeBlond, Taper Attachment
19"x8' Sidney
27"x9' Bridgeford

MILLERS

#2 S.P. Van Norman, Plain
#2 Cincinnati, Vertical, Dial Type
#4 Cincinnati, Universal

TURRETS

#2B Foster, Universal
#2A Warner & Swasey
#4 Warner & Swasey

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Cap. ½" x 72", M. D.
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MACHINE TOOLS

84" Cincinnati HYPRO Vertical Boring Mill
#18 Blanchard Surface Grinder, 30" Chuck
16"x72" Norton "C" Plain Grinder
#262 Barnes Upright Drill, box column
5'-17" Cincinnati-Bickford Super-Service Radial
7½" 6-spindle Goss & DeLeeuw Automatic Chucker
#2L Van Norman Plain Miller
8"x48" J. & L. Thread Grinder
#3, #4, and #5 Warner & Swasey Universal TURRET LATHES

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#2H Kearney & Trecker Vertical Miller
#1-18 Cincinnati Plain Automatic Miller, 1944
#1-12 Cincinnati Plain Automatic Miller, 1941
#4 Warner & Swasey Universal Turret Lathe
#5 Jones & Lamson Universal Turret Lathe
#2 Bardons & Oliver Turret Lathe, 1944
#7 Bardons & Oliver Universal Turret Lathe, bar feed.
#12M Morey 2-spindle Vertical Profiler
#13 B & S Universal Grinder
#7A Jones & Lamson Universal Turret Lathe, saddle type, bar and chucking equipment, 1942
36" Bullard Vertical Boring Miller, spiral drive, 1942
#70A Heald Internal Grinder, $1500.00
#25A Heald 16" Rotary Surface Grinder

REYNOLDS MACHINERY CO.
305 Eddy St. Providence 3, R. I.
GAspee 5187

CLOSEOUTS

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2½" Cleveland Spd.
2½", 4" Binsee
66" Niles
54" Colburn, M.D., 2 hds.

TURRET LATHES

Foster Nos. 4, 5, 6, 1B, 3B M.D. Univ.
J. & L. 2¼"x24", 3¼"x36".
Acme 3¼" M.D.
No. 1L Gisholt Univ. M.D.

GRINDERS

P. & W. 14", 18", B.B., Vert. M.D.
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 72A3 Gagematic
Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
No. 55, 60, 65 Heald Int. Hydraulic, M.D.
12" Heald Rotary Arter 12" M.D.
B. & S. No. 2, 2B Surface, M.D.
B. & S. No. 10 1 Cyl.
No. 2 Cincinnati Centerless M.D.
B. & S. No. 1, 3 Universal
#25, #55 G. & L. M.D.

LATHES

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McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone, B.D.G.
14"x6', 16"x6' Hendey
9" LeBlond Automatic
36x30' Putnam M.D.
36x22" Putnam, D.C. M.D.
32"x35' Wickes
Putnam 42x16', M.D. S.C.G.
P. & W. 1x18, 1¼x18 Automatic Lathes

AUTOMATICS

B. & S. No. 2, Hand Screw
Cleveland Model A ½", ⅞", 1¼", 2"
Cleveland Model B 1", 2"
P & J 6A, M.D.
⅞" Cone 4 spindle

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Kalamazoo Metal Band Saws
8" Shap-Rite Shapers
No. 1½ Abrasive Surface Grinder
6x6" Racine Hacksaw

RADIALS

4', 5', 6' American Triple Purpose
4' Cincinnati-Bickford
4' Muller, M.D.; 4' 5' Western, S.P.D.
4' American Hole Wizard, M.D.
4' Fosdick

MILLING MACHINES

Cincinnati, #2 Univ.
No. 3S Cincinnati, S.P.D. rapid trav. M.D.
Nos. 1Y, 0Y, 3, 4 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6, Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler M.D.
K. & T. B. & S., No. 2, 3 like new
B. & S. No. 1, 3, Vert.
No. 8D, Gorton Vertical, M.D.
#3 Van Norman Universal
#2 Conradson Universal
#26 Van Norman Univ.

MISCELLANEOUS

Gorton No. 1S Engraving Machine
6 spindle Avey Drill 15" overhang
Rochester No. 5½" B Hammer
6" Vertical Shaper P & W
Oster Pipe Machines, 4", 6", 8", M.D.
N.B.P. 15" Slotter M.D.
10x10 Peerless Universal Shaping Saw
#7 72 Fellows Gear Shapers
Lennox Throatless shear ¼" cap., M.D.

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Drills, 21" Royersford Bk. Grd. Pr. Feed. New
Drills, sensitive, 2 and 4 Spindls
Drill, #25 Foot-Burt ,motor driven
Drills—New—18" Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear Cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive
22" Buffalo Pr. Fd. Motor Drive, New
16"x6' Hendey Lathe, Quick Change Gear
Magic Chucks #1-2 & 3 and Collets
Pipe Machine, 3" Oster motor drive
Planer 24"x24"x6' Pease, motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathe, and 5 milling machines, pulsin and Uni. Tel us definitey what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

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2-TON—Louden 18'2" Span
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Champion 37'6" Span
American 70' Span
American 47'4" Span
6-TON P & H 77' Span
American 77' Span
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Shaw 73' Span
P & H 30' Span
P & H 87'6" Span
P & H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Emsco 75' Span
Dominion 35' Span
Cleveland 38½" Span
Cleveland 50' Span
Allianse 71'10½" Span
Allianse 53'9" Span
Albany 60' Span
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Case 51' Span
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Morgan 32'3" Span
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P & H 80' Span
P & H 60' Span
Morgan 30' Span
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GRINDER, Surf. No. 5 Abrasive, 14"x48".
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22"x48" Monarch Grd. Hd., M.D., Lathe
20"x48" LeBlond Grd. Hd., M.D., Lathe
22"x48" L. & S. Grd. Hd., M.D., Lathe
22"x11' Lehman Grd. Hd., M.D., Lathe
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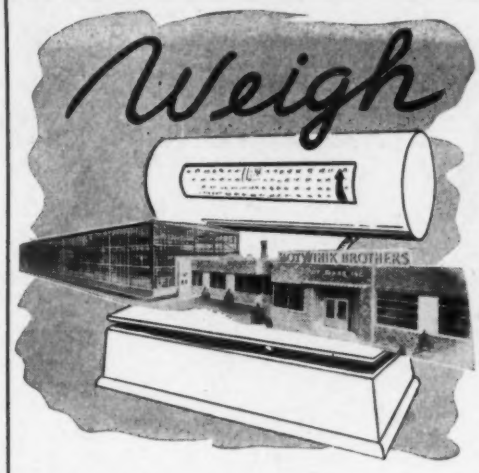

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Bullard 24", 36" and 42" New Era Type Vert. Bor. & Turn. Mills, M.D., Capac.'s and diams. 26", 38", 44", hghts. under cross rail: 20", 24", 33" side heds.
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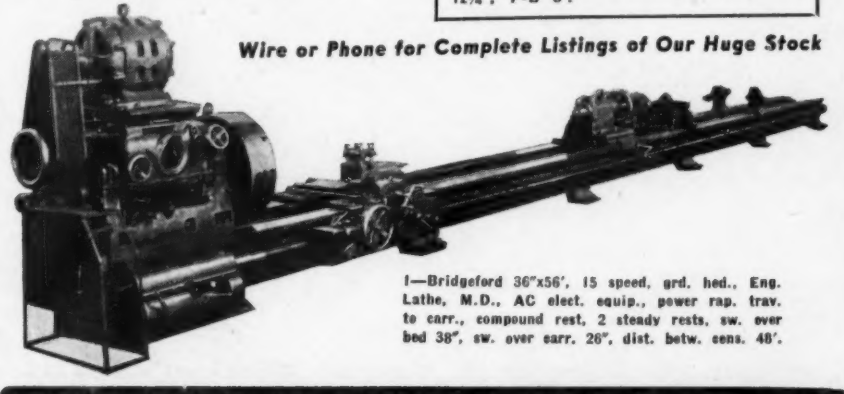

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Spot Arc Welders

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ADVERTISERS INDEX

	Page
Abrasive Machine Tool Co.	245
Adams Co.	78
Air Reduction	64
Allegheny Ludlum Steel Corp.	251
Allis-Chalmers Mfg. Co.	68, 69
Almond Mfg. Co., T. R.	246
Aluminum Co. of America	75
American Brass Co.	48a, 48b
American Broach & Machine Co.	73
American Magnesium Corp.	85
American Optical Co.	270
American Screw Co.	198
American Tool Works Co.	16
Anton Machine Works	254
Apex Machine & Tool Co.	279
Armstrong-Blum Mfg. Co.	277
Armstrong Brothers Tool Co.	31
Atlantic Screw Works	198
Atlas Bolt & Screw Co.	198
Avey Drilling Machine Co.	220
Baker Brothers, Inc.	233
Barber-Colman Co.	72
Bardons & Oliver, Inc.	36
Baumbach Mfg. Co., E. A.	220
Bay State Abrasive Pdts. Co.	71
Bethlehem Steel Co.	255
Bijur Lubricating Corp.	182
Blake Co., Edward	286
Blanchard Machine Co.	89
Blank & Buxton Machry. Co.	228
Bliss Co., E. W.	83
Bodine Corp.	242
Bokum Tool Co.	262
Boston Gear Works, Inc.	217
Bradford Machine Tool Co.	236
Brewer Machine Co., Wm. F.	278
Bridgeport Machines, Inc.	243
Brown & Sharpe Mfg. Co.	56, 57, 204
Bryant Chucking Grinder Co.	87
Bullard Co.	48
Bunting Brass & Bronze Co.	201
Butterfield Div. Union Twist Drill Co.	46
Carboloy Co., Inc.	189
Card Mfg. Co., S. W.	47
Carlton Machine Tool Co.	230
Carpenter Steel Co.	62, 63
Central Screw Co.	198
Chandler Products Corp.	198
Chisholm-Moore Hoist Corp.	266
Cimcool Div., Cincinnati Milling Machine Co.	77
Cincinnati Bickford Tool Co.	93
Cincinnati Gear Co.	216
Cincinnati Gilbert Mach. Tool Co.	240
Cincinnati Grinders, Incorporated	4, 5, 10, 11
Cincinnati Milling Machine Co.	4, 5, 10, 11
Cincinnati Planer Co.	76
Cincinnati Shaper Co.	100
Clark Equipment Co. (Drill Div.)	185
Cleveland Automatic Mach. Co.	3rd Cover
Cleveland Crane & Engrg. Co.	175
Cleveland Punch & Shear Works Co.	84
Columbia Steel Co.	208
Columbus Die Tool & Machine Co.	222
Columbus-McKinnon Chain Corp.	266
Commander Mfg. Co.	260
Cone Automatic Machine Co.	29
Consolidated Machine Tool Corp.	265
Continental Screw Co.	198
Corbin Screw Div., Amer. Hdwe. Corp.	198
Cosa Corporation	241
Coulter Machine Co., James	240
Covel Manufacturing Co.	17
Crafts Co., Inc., Arthur A.	222
Crucible Steel Co. of America	194, 195
Cushman Chuck Co.	267
Danly Machine Specialties, Inc.	50, 51, 96
Darnell Corporation	188
Davis & Thompson Co.	236
Davis Keyseater Co.	230
Dayton Rogers Mfg. Co.	220
Dearborn Gage Co.	186
Defiance Machine Works, Inc.	231
DeLaval Separator Co.	268
Desmond-Stephan Mfg. Co.	250
DeVlieg Machine Co.	38
Di-Noc Co.	285
Disston & Sons, Inc., Henry	252
Dodge Mfg. Corp.	209
Eastern Machine Screw Corp.	286
East Shore Machine Pdts. Co.	246
Errington Mechanical Labs.	278
Evans Reamer & Machine Co.	220
Fafnir Bearing Co.	207
Federal Machine & Welder Co.	274, 275
Federal Products Corp.	269
Fellows Gear Shaper Co.	8, 9
Firth-Sterling Steel Co.	221
Fitchburg Grinding Mach. Corp.	30
Foote-Burt Co.	81
Fosdick Machine Tool Co.	74
Gallmeyer & Livingston Co.	236
Ganschow Gear Co.	218
Gardner Machine Co.	237
Gear Grinding Machine Co.	232
Gear Specialties Mfrs.	80
General Elec. Co., Apparatus Dept.	43, 49, 88
Geometric Tool Co.	64b
Gerotor May Corporation	205
Gisholt Machine Co.	59, 67, 95
Gleason Works	3
Gorham Tool Co.	271
Goss & de Leeuw Machine Co.	280
Govro Nelson Co.	258
Grant Gear Works	218
Grant Mfg. & Machine Co.	222
Gray Co., G. A.	42
Greenfield Tap & Die Corp.	64a
Gulf Oil Corp.	261
Hamilton Tool Co.	240
Hanson Whitney Machine Co.	191
Hardinge Brothers, Inc.	27
Harper Co., H. M.	198
Hartford Special Machy. Co.	218, 244
Haynes Stellite Company	199
Heald Machine Co.	2nd Cover
Heinz, Inc., Howard H.	188
Hendey Machine Co.	238
Holman Reamer Co.	276
Hones, Inc., Charles A.	276
Huot Mfg. Co.	254
Hyatt Bearings Div., General Motors Corp.	203
Hydraulic Press Mfg. Co.	37
Ideal Industries, Inc.	32
Illinois Tool Works	259
Ingersoll Milling Machine Co.	65
International Screw Co.	198
J & S Tool Co.	266
Jacobs Manufacturing Co.	256, 257
James Mfg. Co., D. O.	216
Johnson Machine Co., Carlyle	210
Jones & Lamson Machine Co.	6, 7
Jones & Laughlin Steel Corp.	177
Kearney & Trecker Corp.	39
Kennametal, Inc.	28
King Machine Tool Co.	53
Knight Machinery Co., W. B.	273
Lamson & Sessions Co.	198
Landis Machine Co.	14, 15
Landis Tool Co.	18, 19
Lavalle & Ide	250
Leach Machy. Co., Inc., H.	232
Leland-Gifford Co.	227
Lincoln Electric Co.	90, 91
Lincoln Park Industries, Inc.	300
Linde Air Products Co.	272
Linley Brothers Co.	246

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In addition to controlling precision and tolerances, Brightboy's resilient rubber binder, working simultaneously with the abrasive, cleans and polishes. This action frequently bridges *in one operation* production steps between the grind and the buff; cuts production time.

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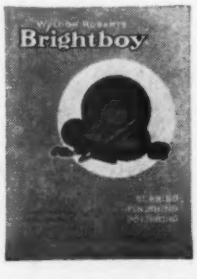
Favorite for burring, finishing and polishing on the widest variety of metals and metal parts.

***BRIGHTBOY TUFF-TEX**
Tougher texture, for finishing hard metals. The tougher binder accents the abrasive action, yet retains the soft rubber cushion, finishing and prepolishing in one operation.

***BRIGHTBOY FINE-TEX**
Smoother, finer texture for work on softer metals, producing special finishes and for applications where the coarser wheel might not be suitable.

Beat today's rising production expenses by asking your dealer for applications data and catalog on cost-saving Brightboy. Or write to have a Brightboy technician call to recommend operation short-cuts.



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the **SOFT-RUBBER BINDER CUSHIONS** *the Abrasive*

ADVERTISERS INDEX

	Page
Lodge & Shipley Mach. Tool Co.	167
Luers, J. Milton	278
Marshalltown Mfg. Co.	222
Master Electric Co.	58
Matthews & Co., James H.	254
McGraw-Hill Book Co., Inc.	258, 278, 286
Mead Specialties Co.	204
Meehanite Metal Corp.	183
Meisel Press Mfg. Co.	218
Metro Tool & Gage Co.	263
Michigan Tool Co.	171
Mid-West Abrasive Co.	44
Milford Rivet & Machine Co.	198
Miller-Knuth Mfg. Co.	276
Mitts & Merrill	218
Modern Tool Works	265
Monarch Machine Tool Co.	173
Moore Special Tool Co.	192
Morse Chain Co.	211
Morse Twist Drill & Machine Co.	24, 25
National Acme Co.	33
National Lock Co.	198
National Lock Washer Co.	206
National Machine Tool Co.	254
National Screw & Mfg. Co.	198
Newark Gear Cutting Machine Co.	240
New Britain-Gridley Mach. Div., New Britain Machine Co.	148
New Departure Div., Gen. Motors Corp.	179
New England Screw Co.	198
New-Field Machine Parts Co.	228
Niagara Machine & Tool Works	223
Nicholson & Co., W. H.	262
Nicholson File Co.	184, 193
Noble & Westbrook Mfg. Co.	266
Norgren Co., C. A.	190
Norton Company	22, 23, 40, 41
O.K. Tool Co.	278
Oakite Products, Inc.	94
Oliver Instrument Co.	276
Orange Roller Bearing Co., Inc.	181
Osborn Mfg. Company	202
Parker-Kalon Corp.	198
Pawtucket Screw Co.	198
Perkins Machine & Gear Co.	200
Pheoll Manufacturing Co.	198
Philadelphia Gear Works, Inc.	215
Phillips Screw Mfrs.	198
Porter-McLeod Mach. Tool Co., Inc.	230
Potter & Johnston Machine Co.	86
Pratt & Whitney Div., Niles-Bement-Pond Company	61
Production Machine Co.	258
Racine Tool & Machine Co.	212
Rwy. Exp. Agency Air Exp. Div.	196
Randall Co., Frank E.	260
Rano Bronze Corp.	206
Reading Screw Co.	198
Reed-Prentice Corp.	229
Reeves Brothers, Inc.	281
Reynolds Metals Co., Inc., Aluminum Div.	197
Rhoads & Sons, J. E.	204
Richardson-Allen Corp.	208
Rivett Lathe & Grinder, Inc.	54
Roberts Rubber Co., Weldon	302
Rockford Machine Tool Co.	60
Rolled Thread Die Co.	226
Russell Burdsall & Ward Bolt & Nut Co.	198
Ruthman Machinery Co.	206
S.K.F. Industries, Inc.	283
Scovill Manufacturing Co.	198
Shakeproof, Inc.	198
Shore Instrument & Mfg. Co., Inc.	230
Sidney Machine Tool Co.	26
Sier-Bath Gear & Pump Co., Inc.	216
Simonds Saw & Steel Co.	55
Skinner Chuck Co.	304
Smith Corporation, A. O.	20
Snyder Tool & Engrg. Co.	92
Socony-Vacuum Oil Co., Inc.	253
Sommer & Adams Co.	224
South Bend Lathe Works	70
Southington Hardware Mfg. Co.	198
Springfield Machine Tool Co.	52
Standard Pressed Steel Co.	196
Standard Tool Co.	247, 248
Starrett Co., L.S.	146
Steel Company of Canada, Ltd.	198
Steelweld Machy. Div. Cleveland Crane & Engineering Co.	175
Sterling Bolt Co.	198
Sterling Grinding Wheel Div.	264
Strand Co., N. A.	262
Stronghold Screw Pdts., Inc.	198
Stuart Oil Co., Ltd., D. A.	260
Tannewitz Works	222
Taylor Machine Co.	218
Texas Co.	98
Thompson Grinder Co.	82
Tidewater Associated Oil Co.	239
Timken Roller Bearing Co.	4th Cover
Torrington Co.	220
Tungsten Electric Co.	249
Union Carbide & Carbon Corp.	199, 272
Union Twist Drill Co.	45
U. S. Drill Head Co.	262
U. S. Products Co.	276
U. S. Steel Corp.	208
U. S. Steel Supply Co.	208
V. & O. Press Co.	230
Van Keuren Co.	79
Van Norman Co.	12, 13
Veraloy Products Ltd.	196
Vinco Corporation	21
Vulcan Tool Corp.	66
Waldes Koh-I-Noor, Inc.	187
Walker Co., Inc., O. S.	244
Walker-Turner Co., Inc.	225
Waltham Machine Works	226
Warner & Swasey Co.	34, 35
Warren City Mfg. Co.	219
Westinghouse Electric Corp.	234, 235
Whistler & Sons, Inc., S. B.	169
White & Bagley Co.	208
Wilson Mechanical Co.	260
Wolverine Bolt Co.	198

SEARCHLIGHT SECTION
Classified Advertising

Classification	Page
BUSINESS OPPORTUNITIES	288
CONTRACT WORK	287
Buxton Co., John L.	287
General Pattern Works	287
Jarvi Mfg. Co., Inc., C. W.	287
La Salle Engineering Co.	287
M & N Machine Tool Works	287
Possy's Tool & Mfg. Co.	287
Wayne Mfg. Co.	287
EMPLOYMENT SERVICE	287
PATENT ATTORNEY	287
POSITIONS VACANT	287
POSITIONS WANTED	287
REBUILDING SERVICE	294, 296, 297, 299
Botwinik Bros., Inc.	294
Botwinik Bros. of Mass., Inc.	299
Hill-Clarke Machy. Co.	296
Simmons Machine Tool Corp.	297
SELLING OPPORTUNITIES	288
SPECIAL SERVICES	288
WANTED TO PURCHASE	288
USED EQUIPMENT	288-299
Aaron Machy. Co., Inc.	294, 297, 298, 299
Bernstein & Co., George M.	299
Botwinik Bros. Inc.	294
Botwinik Bros. of Mass. Inc.	299
Bennett Machy Co.	292
Brooks, B. D.	298
Brownell Hazard	297
Cessna Aircraft Co., The	288
Continental Salvage & Mchy. Corp.	299
Delta Equipment Co.	297
DeWitt Tool Co.	288
Dony Machinery Co., D. E.	299
Eastern Machinery Co.	295
Economy Co., Inc.	298
Emerman Machinery Co.	293
Eveready Supply Co.	294
Falk Machinery Co.	289
Farnham Mfg. Co.	288
Galbreath Mchy. Co.	296
Gotham Mchy. Corp.	292
Hasco Machinery Co.	298
Hill-Clarke Machinery Co.	296
Hyman & Son, Joseph	297
Indianapolis Machy. & Supply Co.	290
Interstate Mchy. Co., Inc.	290
Johnson Mchy. Co.	294
Kings County Machinery Exchange	292
Lang Machinery Co.	298
Mandel-Camras Mchy. Co., Inc.	299
Morey Machinery Co., Inc.	291
National Machy. Exchange	292
Northern Pump Co.	294
Osborne & Sexton Machinery Co.	298
Ott Machinery Sales, Inc.	292
Paul's Motor & Machy. Supply	298
Petitt Bros. Mchy. Co.	288
Reynolds Machinery Co.	297
Salter, Jay	298
Saunders Co., N. M.	288
Shook Bronze Corp.	288
Simmons Machine Tool Corp.	297
Smith Machine Tool Co.	294
Sun Mchy. Co.	292, 298
Vard, Inc.	288
West Penn Machinery Co.	299
Wigglesworth Machy. Co.	296
Zeeve & Co., Alex.	292

(ADVERTISEMENT)

SKINNER Chucks NEWS

THE CREST OF QUALITY

PUBLISHED BY THE SKINNER CHUCK COMPANY, 343 CHURCH ST., NEW BRITAIN, CONN.

DISSA and DATA

A modern power chuck is a precision mechanism and must be treated with the same respect as the machine on which it is used. Operators should be shown all lubrication points and given instructions on when and how to oil the chuck.

A good general rule to follow when ordering independent chucks is to specify a chuck diameter two to three inches less than the swing of the machine on which it will be used.

Attempting to hold oversize work in any chuck causes the jaws to overhang, imposing undue strains on the chuck parts and should be avoided whenever possible. Also be sure to support long work with tailstock center, as greater accuracy and more satisfactory results will be obtained.

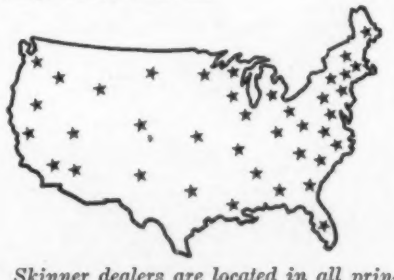
SKINNER SAFETY

Did you know that a Skinner Wedge-type Power Chuck will hold even when the air supply has been cut off? Comprehensive tests have proved that a Skinner chuck grips the work just as solidly after the air supply has been cut off—a crowbar was used in a futile effort to loosen the work being held.

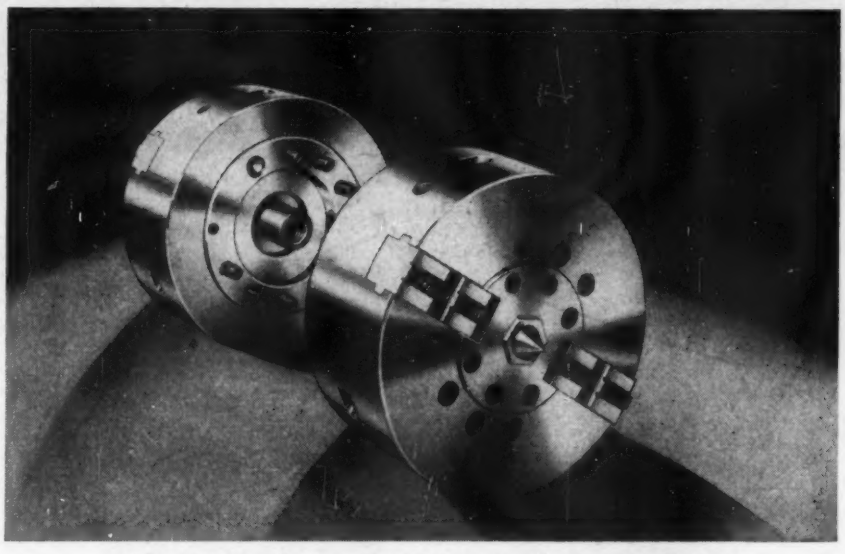
SKINNER chuckles

A tombstone usually speaks well of a man when he's down.

The good old days were those when there were two cars in every garage. Now, it's two families.



Skinner dealers are located in all principal cities — consult the one nearest you for complete details on Skinner products.



New Skinner Series 23100-A Compensating Power Chuck

A GREAT NEW SKINNER COMPENSATING POWER CHUCK

With an Exceptionally Sturdy, Precision Center

New Britain, Conn.—Another new air chuck is being manufactured by the Skinner Chuck Company of this city. Called the 23100-A, it is a two-jaw compensating power chuck of a special design that facilitates driving uneven castings, rough forgings and similar hard-to-grip pieces on centers. The new chuck is especially useful where exceptionally heavy cuts are being taken with carbide tools at high spindle speeds.

Construction of the 23100-A is rugged and precise. All parts are made of selected alloy steels, specially heat-treated for their particular functions. The compensating action is provided by a unique design feature that links a rocker arm and plunger to the two floating, non-adjustable jaws.

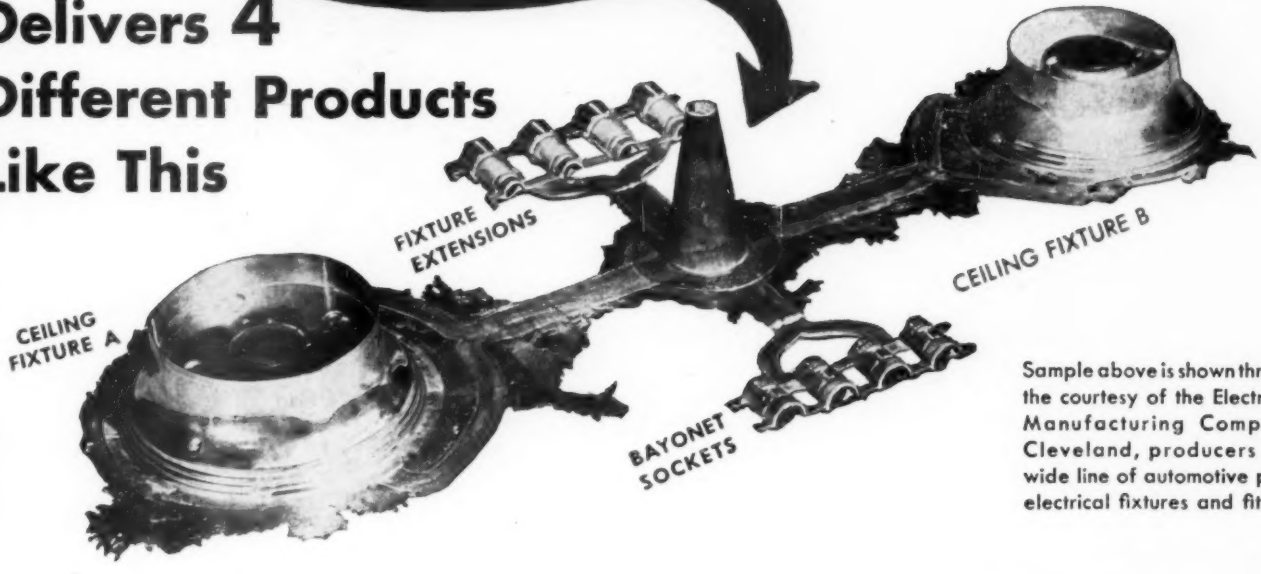
The new 23100-A is a real value in a power chuck. It will speed machining of rough pieces by cutting down chucking time and assuring faster, more precise metal removal. And another thing — the new 23100-A is built to last — whether it's used intermittently or constantly, easily or severely — because it's built to Skinner standards of quality workmanship. For complete details see your Skinner dealer or send for catalog that covers all Skinner products.

HAND & POWER OPERATED MACHINE CHUCKS—AIR CHUCK EQUIPMENT —FACE PLATE JAWS—MACHINE VISES

ONE SHOT

on this CLEVELAND DIECASTING MACHINE

Delivers 4 Different Products Like This



Sample above is shown through the courtesy of the Electroline Manufacturing Company, Cleveland, producers of a wide line of automotive parts, electrical fixtures and fittings.

Using a new type four-gate divided die, which has the added advantage of permitting combinations of varying quantity requirements. When one short run item is completed a section of the die can be detached from the master die, another inserted and production resumed. By maintaining a variety of sections matched to the master die it is easy to schedule flexible and economical production of a wide variety of high grade die castings. Let us show you further evidence of the economy of production with Cleveland Die Casting Machines.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

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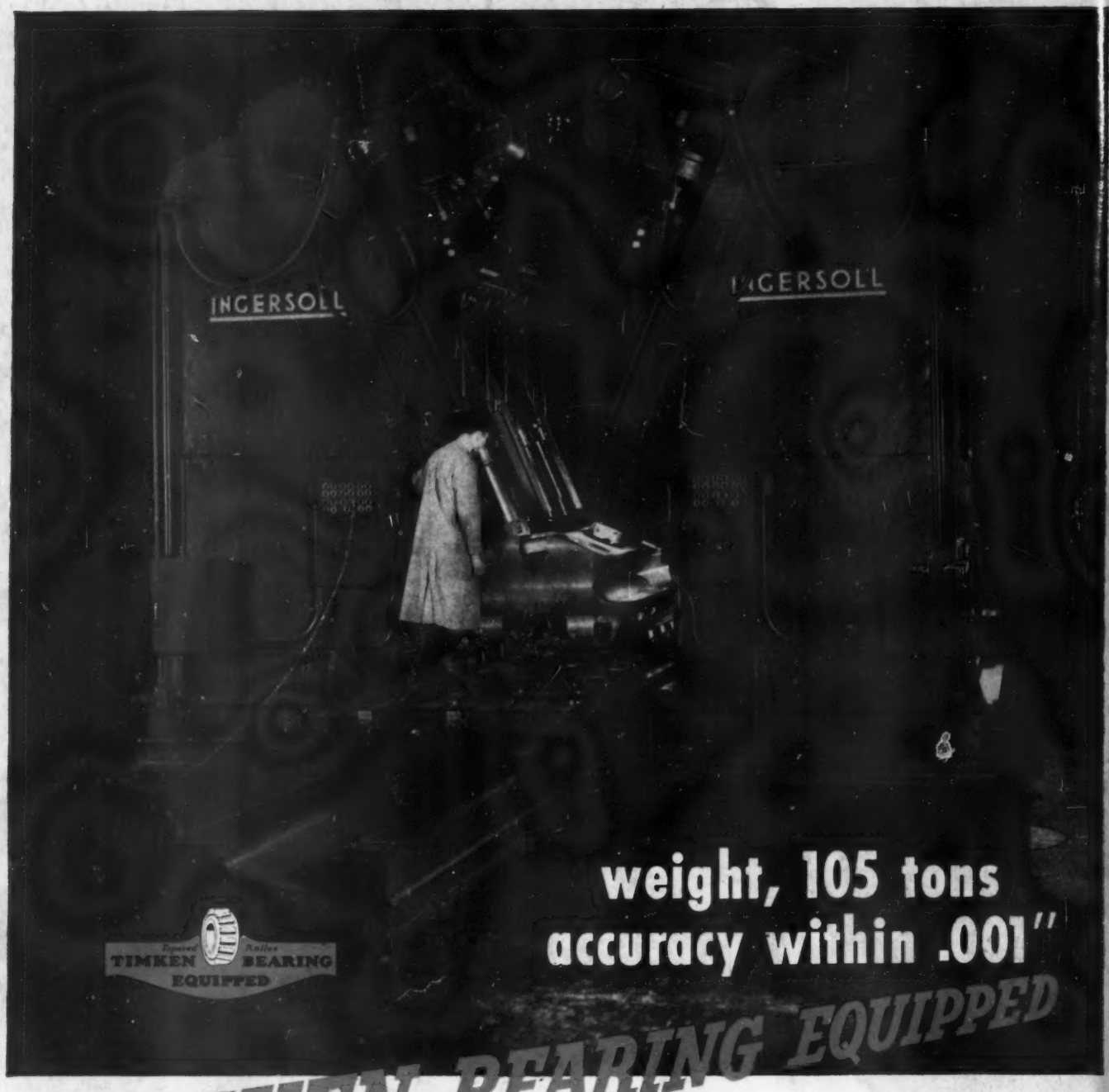

TIMKEN BEARING

To be sure of getting Timken Bearing performance, look for the trade-mark "TIMKEN" stamped on every bearing you use.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

This big brute of a machine was designed and built by The Ingersoll Milling Machine Company, Rockford, Illinois, for a large locomotive company.

It is officially designated as a Four Spindle, Table Type, Inclined Duplex Housing Boring Machine and is used to bore 12 and 16 cylinder Diesel engine blocks with Tungsten Carbide tooling.

Naturally a machine of this kind has to be tremendously strong and rigid to stand up under this heavy duty service and maintain such close operating tolerances, the required accuracy being minus .000 plus .001 at several points.

As an important factor in attaining and maintaining this precision, the machine manufacturer mounts all spindles on Timken Tapered Roller Bearings — a practice generally followed throughout the machine tool industry in precision machines of all kinds.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO